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A Monthly Review of Meteorology
—AND—
Allied Branches of Study.

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THE AMERICAN

Meteorological Journal.

VOL. I. DETROIT, DECEMBER, 1884. NO. 8.

CURRENT NOTES.

THE colored ring about the sun, noted in our preceding numbers, has been generally observed in Europe.

THE Roumanian government is about to establish a meteorological service, which will probably be under the direction of M. S. Hepites, engineer, educated at Brussels.

A REMARKABLE storm occurred over Quebec (province) on Nov. 5th and 6th. It was accompanied by a very high tide on the night of the 5th and another not so high on the 6th. The waves at Father Point were reported to be 50 or 60 feet high. Much destruction occurred among shipping and on shore. At Quebec (city) alone it is estimated as high as half a million of dollars.

AN explosion of four or five tons of "Great Western" powder occurred near Toledo Nov. 13, shortly after ten o'clock. A hole forty feet in diameter and sixteen feet deep was scooped out in the earth by the explosion. The shock was felt at Cleveland, Detroit and Adrian, but it failed to leave any trace in the curve described by a Hough's barograph at Ann Arbor, though the latter place is only about 45 miles distant and is somewhat nearer than Detroit. It was reported as an earthquake shock in Essex County, Ontario.

On Oct. 15 Tokio and Yokohama were visited by a severe *earthquake shock*, the worst for four years. The damage was slight. On Nov. 12 a slight shock was felt in New Hampshire early in the evening. It was most severe at Warner. On the 15th a severe shock occurred at Clitheroe in Lancashire, England. It was accompanied by a terrific explosive report. Speaking of earthquakes reminds us of Herr Bucchich's belief—stated in the *Journal of the Austrian Meteorological Society*, apropos of the shock at Lesina Sept. 8—that he had a brief premonition of the phenomenon. In this and one other case he had been awakened a few seconds before the shock by an undefinable feeling of discomfort. He thinks that animals usually show uneasiness before such phenomena.

On the Isthmus of Panama as in all intertropical countries there are two distinct seasons, the dry and the wet, the "verano" and the "invierno." The first commences about the end of November and the second during the month of May. There is a short cessation of rain, during the solstice of June of about twenty days.

The mean temperature at Colon for the year 1882 has been 79°, at Naos 80°, at Gamboa 58°; the two extremes are at Colon 64° and 94°, at Gamboa 52° and 98½°, at Naos 67° and 94½°.

More rain falls at Colon than any other point and less at Naos. Rains are the most abundant at Colon at the beginning of the rainy season in November, per contra at Naos, on the Pacific, the rains are the most abundant in May or June when the dry season is at hand. Gamboa about midway seems to be more subject to the influence of the Pacific than the Atlantic ocean, and the rains are also greatest during May.

The tides at Colon are but slight, varying from 1½ to 2 feet, while at Naos on the Panama side they rise and fall from 16 to 18 feet.

During the dry season the trade winds prevail, but in the rainy season the winds are feeble and variable. The air is always more or less charged with moisture; the climate is therefore debilitating, especially to the whites, but with ordinary precautions in diet and taking care not to be exposed to dampness and especially avoid to keep on wet clothing, ordinary good health can be maintained.

The records of deaths kept by the company show that during June, July and August, 1883, the proportion has been 3 per thousand; from September, 1883, to March, 1884, 5½ per thousand, and for April and May, 1884, again 3 per thousand. The company has provided a full corps of physicians to attend to the workmen and

employes distributed all over the line. A fine and large hospital has been put up at Panama; Colon has also a hospital built on the sea-side, small post hospitals are distributed over the line. Nothing has been spared to provide for the health and comfort of the workmen, now numbering about 20,000, mostly blacks from Jamaica, some natives, and men of different nationalities.

The demands for labor has created a strong emigration from Jamaica to the Isthmus, and shiploads upon shiploads of blacks are discharging constantly. These men used to a warm climate resist the debilitating effect of the Isthmian climate better than laborers from northern climates.

Since a falsehood well repeated may be looked upon as the truth, it may not be inappropriate to refute again here one of the popular stories told about the insalubrity of the Isthmian climate. It is popularly believed that there is a man buried on the Isthmus for every tie laid on the railroad. To prove the absurdity of this story it is an easy matter to make a calculation. The Panama Railroad is about 47½ miles long, it requires about 74,000 ties for that distance so that according to popular belief there are 74,000 men buried on the Isthmus in consequence of building the railroad. At no time has the railroad company had more than 4,000 men altogether on the railroad works. Modern arithmetic is sufficient to solve this problem. —*Jour. Franklin Inst.*

Dr. Wild, the eminent Russian meteorologist, protests against the methods of *the sling-thermometrists* in the October number of the *Austrian Meteorological Journal.* He thinks that the sling-thermometer is subject to radiation so that it does not show the true temperature or humidity of the air, while all that is desirable in the method can be got from ventilators in thermometer protection-houses.

From the Greenwich Observations for 1882, which have lately come to hand, we learn that *a remarkable solar storm* occurred on May 13, 1882, ending at $1^h\ 15^m$ Greenwich time. It was seen on the edge of the sun at a positive angle of 296° from the sun's axis. A projection was thrown out at a rate which corresponds to a motion of recession from the observer of 325 miles per second. It is now in order to search the records to see if there was any sympathetic disturbance whatever on the earth. The records accessible to the writer do not show any.

THE Greenwich Observations for 1882 contain automatic graphical records of the earth-currents observations taken in the latter half of the year. The more remarkable fluctuations of the magnetic elements for the year are given on 24 plates, the most of which give the register of two earth-currents in addition to the declination and horizontal and vertical magnetic forces. The earth-current observations are made by means of a wire whose ends have good ground-connections and in whose course is placed a galvanometer. A mirror placed on the suspended magnet reflects light on a cylinder covered with prepared paper. The ground-connections, taken as represented by the line connecting the grounds of the wires, are nearly N. E. and S. W., and N. W. and S. E., and are 3 and 2½ miles long, while the wires, carried to the registering instrument in the Observatory are 7½ and 5 miles long. Great variations in strength, and even reversals of direction, are observed especially in the N. E. and S. W. ground-connection. These fluctuations precede by a few minutes, usually, changes of similar character in the magnetic elements, more especially the declination and horizontal force.

The Royal Observatory also carries on observations of the electric potential of the atmosphere. For 1882 the mean monthly maximum falls in January and the minimum in July. For the day the maximum is at 10 P. M., the minimum at 10 A. M. This is for all days; for rainy or non-rainy days taken by themselves the progress is not so regular. In the rainy hours from 10 A. M. to 7 P. M. only is the monthly mean negative. In all other cases the mean potential of the air is positive.

THIS Review for September, 1884, of European weather is kindly prepared by Mr. Burysmann:

Barom. Pressure.—On the first there is a low pressure over the North Sea and another over Ireland and Scotland; high pressure is to be found over Italy, France and Austria and also over the Gulf of Bothnia; on the 2nd the minimum over the North Sea has disappeared, but northwest of Ireland the pressure has decreased, and travelling southeast this depression hovers on the 4th over the canal between England and France; another is central in northern Italy; the first travels northward and on the 6th has reached the vicinity of Sumburgh Head on the Shetlands. Another disturbance coming from the S. W. has travelled N. E.-ward and on the 7th is central near Shields on the eastern shore of Scotland. On the 8th it hovers over Denmark, causing rain and thunderstorms in Ger-

many, and also precipitation in Britain and Sweden; but on the 9th this minimum is filled up and the pressure over the greatest part of Europe is very equally distributed. A minimum over France is joined on the 10th by another over North-Sweden, so that high pressure spreads over Scandinavia and northern Germany. No change occurs and clear weather prevails over central Europe with high temperature till the 17th, when a slight depression is situated in northern Russia, causing rain in Finland but disappearing on the 18th. On the 19th another is central over North Scandinavia and on the 20th over West Russia causing rain there and in Eastern Germany. On this date there is also a minimum in the northwest spreading on the 22nd over Scandinavia, Britain, Holland and Northern Germany; by this time the high pressure over Central Europe has travelled to western Russia. The low pressure travels northeasterly and on the 23rd is situated near "Bodo" on the north Norwegian coast. Again high pressure hovers on this date over France and spreads over Germany on the following day. On the 24th another minimum appears on the northwest coast of Scotland and on the 27th becoming more intense, so that the barometer at Stonaway stands at 28.93, it travels to the north causing stormy winds over Britain and severe storm on the Norwegian coast, and is nearly filled up on the 30th when another depression southwest of Ireland causes there and in Scotland storm and rain with rapidly falling barometer.

Temperature: Germany—The temperature is from the 1st to the 4th, 11th to the 20th, and from the 28th to the 30th above; from the 8th to the 10th, and from the 21st to the 27th below, the mean. Lowest temperature on the 27th at Bamberg 39°. Highest temperature on the 3rd at Breslau 79°.—

Russia—St. Petersburg—The temperature was from the 1st to the 5th, and from the 15th to the 23rd below; from the 4th to the 14th, and from the 24th to the 30th above the mean, Highest temperature on the 7th 68°, lowest on the 22, 34°.—

Sweden—Stockholm—The temperature was from the 1st to the 19th and from the 21st to the 30th above the mean only on the 20th it was below the normal. Highest temperature on the 9th, 70°; lowest on the 20th 44°.—

Ireland — Valentia—The temperature was from the 1st to the 7th about normal; from the 8th to the 20th, from the 27th to the 28th, and on the 30th it was above; from the 22nd to the 26th, and on the 29th it was below the mean. Highest temperature 70° on the 12th, lowest, 52° on the 26th.

CONCERNING the heat and drouth of the past summer in England we extract the following from the report of C. L. Prince, Esq,, Crowborough, Sussex:

It has been supposed by many persons that the heat and drought of the past summer have been without precedent during the last fifty years; but I think the following extracts from my journal will show, very conclusively, that such an idea is incorrect.

I will first consider the subject of mean temperature in the shade, as follows:—

Mean Temperature in the Shade during the Summer Months.

1846	...	...	64.6°
1847	...	...	63.0
1852	...	...	63.3
1857	...	...	64.6
1859	...	...	64.7
1884	...	...	62.6

During the last forty-one years there have been six other instances wherein the summer heat has nearly equalled that of the season just terminated, viz:—

1851	...	...	62.3°
1858	...	...	62.2
1866	...	...	62.0
1868	...	...	62.0
1870	...	...	62.3
1876	...	...	62.0

With respect to the rainfall, the following table will show that during the past forty-one years there have been four instances wherein the drought has been more severe than during the late summer:—

Total Rainfall during the Summer Months at Uckfield.

1844	...	...	4.49 inches
1847	...	...	3.07 "
1870	...	...	4.60 "
1874	...	...	4.65 "
1884	...	...	5.12 "

The mean summer rainfall for the above long period has been 7.07 inches; therefore the *deficiency* for 1884 has been little more than a fourth of the average (at Uckfield).

But it may be said that the rainfall was very deficient during the spring, which seriously affected the water supply for the summer months. I therefore insert the following table, which shows the amount of rainfall during the spring and summer months in the

above-mentioned years, in all of which the amount was less than for 1884:—

Rainfall from March 1st to August 31st in each Year at Uckfield.

1844	... ...	7.36 inches
1847	... ...	6.06 "
1870	... ...	7.69 "
1874	... ...	8.22 "
1884	... ...	8.69 "

NORTH AMERICA has done its share in the *production of new volcanoes*, three of which have been made within the observation of civilized man. Jorullo, in Mexico, appeared in a plain in September, 1759. It is now quiescent, and the hot and devastated district about it is now cooled down and covered with vegetation. Izalco, in San Salvador, appeared early in 1770 on what had been a fine cattle hacienda. It is now 2500 feet high and is in such constant eruption as to deserve the name "El faro del Salvador"—the pharos of Salvador. The third is the Volcano of Bogosloff, in Behring Sea, about 20 miles northwest of Unalaschka Island. It originated in the open sea, and the disturbances which marked its appearance began in 1796. The volcanic island was small and reached its maximum about twenty years after, when it was about a mile in circumference and 2100 feet high. The early accounts of it are curiously discordant, but it seems to have gradually grown smaller for many years and its volcanic energy to have remained quiescent. In 1883, however, it waked up again, and it has now a small addition to the southwest of the old island: This is about a quarter of a mile long, somewhat less in breadth and connected with the old island by a sand-spit rather more than a quarter of a mile long. It was visited in the latter part of May of this year by Lieut. Stoney and was found to be an active crater 357 feet high. We judge from his description that its activity has already passed the maximum and is now dying out.

The volcano so repeatedly reported in Florida during the past year proves to be only the steam rising from sulphur pools on an unexplored part of Ancilla River. That of Chester Co., South Carolina, we have already reported as simply a rumbling due to underground streams. Of that in West Virginia we can only say that distance must lend activity to it, for the West Virginians know nothing of it.

Quite recently a new volcanic island has been reported from Ice-

land. It appeared early in the Summer off Cape Reykjanes. No volcanic phenomena accompanied its appearance, though they had happened at the same spot two years ago. It was seen first on July 29, and is 8 or 10 miles from the cape.

THE receipt of the full and attractive year-books of the meteorological observatory of the *Magdeburger Zeitung* calls renewed attention to one of the most notable newspaper enterprises in existence. This observatory is one of the first order, very complete in all its details, is under the direction of Dr. Assmann with a corps of assistants, publishes a monthly meteorological journal, is building up a local weather service, and plays an important part in the general European service—and yet it is the private enterprise of the Messrs. Faber, the proprietors of the *Magdeburger Zeitung*. A more praiseworthy newspaper enterprise does not exist, and there have been very few which were more extensive.

The observatory occupies the lofty tower of the publishing house and the neighboring court. In addition to the usual instruments, it has the necessary arrangements for studying temperature from a depth of 5 meters to an altitude of 32 meters; it also has continuous registers for pressure, wind (both velocity and direction), rain and sunshine, and it is now carrying on daily observations of the depth of ground-water. In the year-books these various data are recorded with sufficient fullness. For 1881–2 a copy is given of the 36 most remarkable sudden fluctuations of the barometer, all of which can be connected with thunder-storms or other sharp meteorological changes, generally the former. In the annual for 1883 the entire continuous barometric register is reproduced. It is interesting to note that five distinct fluctuations occur for the Krakatoa air-swells. The sunshine record is also graphically reproduced, and as one turns over the leaves of this record he finds faithfully pictured the sunny Saxon summer and the gloomy, cloudy, foggy, misty Saxon winter, which many American students remember well.

The ground-water record interests especially, because we are learning what an important part it plays in the agricultural and sanitary climate of a country. The depth of water below the surface here was about 20 feet for the latter half of 1883. The records start in with 5.3295 meters on July 21, run rapidly up to 5.3572 on the 30th, then fall to a minimum of 5.2936 through the second week in Nov., to rise again slow through the rest of the year to 5.3258 meters.

THE author of the communication on *British Earthquakes* printed in this number of our Journal, has, for several years, been directing his attention to Dynamical Geology and Seismology; publishing, from time to time, the results of his investigations.

During the year 1858, in an 8vo volume, entitled "Key to the Geology of the Globe, an Essay designed to show that the present geographical, hydographical and geological structures, observed on the earth's crust, were the result of forces acting according to fixed, demonstrable laws, analogous to those governing the development of organized bodies." Prof. Owen showed that the average trend of continental coasts formed an angle of about $23\frac{1}{2}°$ with meridian lines: that, therefore, these coast lines were Secondaries to certain phases of the ecliptic. In 1871, he read at the Indianapolis meeting of the A. A. A. S. a paper on Terrestrial Magnetism,[1] and followed up the subject in the March and August numbers of the *Journal of the Franklin Institute.* For the "*Polyt. Review*" (New York, Dec. 1878) he furnished a diagram with explanatory text, presenting the fact that the five main continental eastern trends (Oceanica included as sunken continent) were $\frac{360}{5}°$ or 72 degrees apart, estimated at the equator.

The paper read by Dr. Owen at the Boston meeting,[2] demonstrated that a radius of $\frac{72}{2}°$ or 36° from a given center, embraced respectively each of the continents, exclusive of some peninsulas; and that between that circle and one formed by a radius of 24° from same centre, were enclosed usually only Cenozoic formations, while the *older* formations were contained within the smaller circle. The same paper pointed out Mount Rosa in Switzerland as occupying the position of the pole of the land-hemisphere and as being the area toward which the great depressions and elevations of Europe, (including the Red Sea and Persian Gulf in Asia) all point or trend; and from which many of the main rivers flow.

The probability of the mean centre of oscillation for the magnetic system being on the same meridian as the centre of land, and near the centre of Africa, viz., at or about St. Thomas' Island, in the Gulf of Guinea, is demonstrated. From this centre a radius of 36° touches Gibraltar, the Red Sea, Mozambique Channel, the Cape of Good Hope, and the Madeira Islands; and is equidistant from the magnetic foci.

An account of the results of tri-daily observations on the relative strength and direction of earth-currents, tested by a delicate gal-

[1] Vol. XX. of Pro., p. 208.

[2] Vol. YXIX, p. 437.

vanometer during several months in the campus of the Indiana State University, was published in the *New York Tribune* (May 28, 1878) and *Indianapolis Journal*, the latter in several numbers illustrating the sun as the chief dynamical agent. A description and diagram of a magnetic globe, illustrating the declination, appeared in the St. Louis *Valley Naturalist* of Oct., 1878. Subsequent investigations, in terrestrial magnetism, were given in the *Sc. Am. Supp't* for March, 1884.

A paper on the Law of Fissuring,[3] as applied to our earth (particularly at the pole of the land-hemisphere in Switzerland), and also as applicable to organic bodies, was sent to the Montreal meeting. At the Minneapolis meeting, as connected with the same general subject, Dr. Owen furnished a paper on the "Earth's Orographic Framework,"[4] showing that not only is our globe braced, east and west, by a great chain of mountains, passing, with little interruption, through the pole of the land centre for over 7,000 miles, from the Cantabrians to Java, but also that it is strengthened, north and south, by the 8,000 miles long Rock Mountain and Andean backbone, and finally diagonally from Hindoo Kush to Behring's Straits, a distance of about 4,500 miles. In a paper on Seismology,[5] he shows that zones on the two former great circles, as well as also along most of the radial great circles, passing through the land centre (especially the zone each side of the prime vertical, where Mt. Rose is at the zenith) furnish important evidence of great seismic activity, in those regions. X.

THE connection between meteorology and seismology is faint and distant, but in spite of this they are often considered together; the sufficient reason for their association in this country is that a good share of the better observations of our earthquakes is now made at the Signal Service and other meteorological stations. In order to increase the accuracy and number of such observations, a conference was recently held in Washington, on invitations of Major J. W. Powell, Director U. S. Geological Survey, to consider plans for the more systematic record and discussion of our occasional distances. There were present Messrs. Powell, Dulton and Gilbert, of the Geological Survey, Abbe and Marvin of the Signal Service, Paul of the Naval Observatory, Rockwood of Princeton and Davis of Harvard College. The Director of the Geological Survey undertakes

[3] Vol. XXXI, p. 337.
[4] Vol. XXXII, p. 253.
[5] Vol. XXXI, Pro. Montreal Meeting, p. 329.

to attend to the executive details of the work, and is assured of the co-operation of the Signal Service and other government bureaus. A committee consisting of Messrs. Paul, Rockwood and Marvin, is to consider the construction of a standard seismometer, to be mounted at first-class stations; and of a seismograph of less cost, for second-class stations. In addition to this, circulars of instruction for ordinary observations are to be prepared and distributed as widely as possible to all who are willing to make earthquake reports; these will be observations of the third-class. It is hoped that a sufficient number of stations of the three classes can be found among the Signal Service stations and its voluntary observers with the tornado and thunder-storm reporters, the State weather services, the army arsenals and the navy yards, and the observatories and physical laboratories connected with our various colleges, not to mention private observers whose aid will be welcomed. In order to concentrate work upon the areas most frequently shaken, Messrs. Rockwood, Abbe and Davis are to examine the question of relative frequency of earthquakes in different parts of the country; and, in accordance with their report, special attention will be given to securing observers in the more disturbed regions.

Those who are interested in seismometry will find a review of the admirable work lately accomplished in Japan in *Science*.

W. M. D.

THE rapid advance of weather study in Japan is thus recorded by E. Knipping (Mitth. deutch. Ges. f. Natur- u. Völkerkunde Ostasiens, Sept. 1884):

1875—July: first meteorological station established in Tokio.

1881—December: twelve stations in operation; exchange of daily telegrams between Nagasaki and China.

1882—July 1: introduction of metric instead of English measures; three daily observations.

1883—Jan. 1: twenty-one stations; Feb. 16: first daily telegram; March 1: first daily map; April 1: three daily maps; May 25: first storm warning; Aug. 12: receipt of first weather telegram from China in Tokio.

1884—June 1: three daily telegrams, predictions and announcements.

The director of the service is I. Arai; the meteorologist in charge of predictions, etc., Dr. Knipping; all observers, telegraphers, assistants, draughtsmen and printers are Japanese. The ground maps

are printed in blue, with Japanese and English lettering, and the weather conditions are thereupon added in black. The hours of observation are 6 A. M., 2 and 9 P. M., Japan time, which is nine hours later than Greenwich. Accompanying some remarks on the monsoon character of the Japanese winds, the author gives a brief statement concerning storms. Most low pressure centres travel from southwest to northeast; in winter and early spring they advance rapidly, and the depression of the barometer increases to the eastward; in late spring and early summer they travel more slowly, and not seldom rest stationary or are seen to fade away (rainy season); the mid-summer is a dry season, interrupted by occasional violent typhoons with heavy rains, moving slowly from south to north or from southeast to northwest; in autumn the number and rate of progress of the low pressure centres increases, and their track is again from southwest to northeast; among these are the fast-moving typhoons with broadly distributed rains. The larger storms pass over the empire unaffected by its coasts and mountains. It is hoped that the light-houses may be used by the weather-service, thus increasing the number of stations from 24 to 80. W. M. D.

COMMANDER BARTLETT of the Hydrographic Office communicates the following notes on the remarkable *looped-shaped track of the hurricane* on the Georgian coast: The loop-shaped track of the storm which occurred off the coasts of Florida and Carolina from Sept. 13th to Sept. 17th inclusive, and shown on the Pilot Chart issued by the U. S. Hydrographic Office for the month of November, presents such a curious departure from the ordinary course of tropical cyclones that some description of its origin and character will be interesting.

On the morning of Sept. 10th it appeared off the coast of Georgia, the barometer falling .11 in eight hours with fresh easterly winds. The storm center moved inland and northward during the 10th and 11th and then turning back left the coast in the vicinity of Savannah, the Signal Service map at midnight of the 12th showing the center south east of this city.

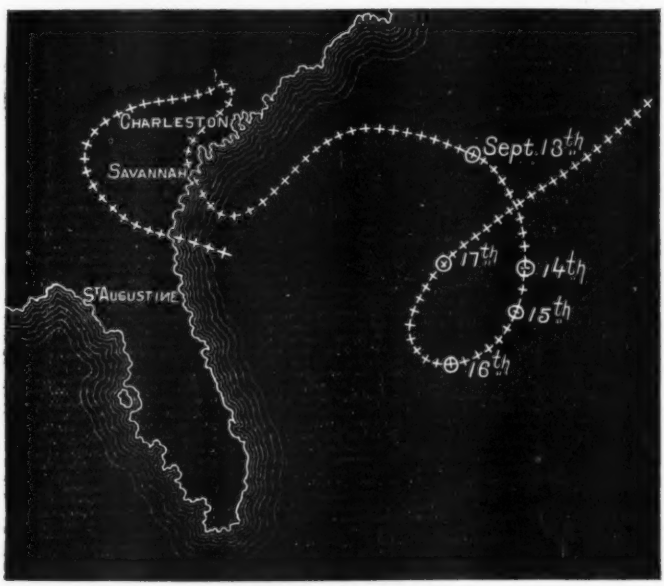
It was not until the 13th, however, that the disturbance assumed the proportions of a hurricane. On this day the steamship "Anerly" in latitude 34° 00′ N. longitude 76° 20′ W. reported strong gales accompanied by heavy rain squalls, wind N. E. Barometer 29, 74.

The diameter of the atmospheric depression thus far seems to have been small, as vessels bound south and east noticed few indications of a gale.

On the 14th the storm centre had moved almost due south, its position being well fixed on that day by the steamships "Gripfast" and "Alpine." The former at 1 P. M. had the wind from N. W. with terrific seas and rain. By 9 P. M. the wind had hauled to N. E. showing the storm was moving still to the southward. The position of this ship at noon was latitude 29° 15′ N. longitude 74° 31′ W., Barometer 29.16.

The steamship "Alpine" had the wind from N. E. blowing a hurricane, mountainous seas running, the ship laboring heavily and shipping quantities of water. Position at noon latitude 30° 47′ N. longitude 74° 36′ W., Barometer 29.46.

On the 15th the storm center was again well determined by the three-masted schooner "R. M. Walls" and the steamship "Gripfast." The former reports that the day came in "with as hard blowing as a man wants to run with, clouds very low and greasy, and heavy banks of vapor, high sea running from N. N. W. to N. N. E." At 1 P. M. barometer stood 29,35. Latitude 29° 27′ N., longitude 75° 29′ W.



TRACK OF THE HURRICANE.

"At 8 P. M. of this day while the wind was blowing at least 80 miles an hour and the air full of salt-water spray, the "R. M. Walls" collided with the brig "Leonard Myers" already disabled and in a sinking condition."

The "Gripfast" experienced continuously heavy gales from N. E. Barometer 29,20. Latitude 30° 03' N., longitude 74° 51' W.

From noon of the 15th to noon of the 16th the center moved south and west; the schooner "Witherspoon" in latitude 28° 27' N. longitude 77° 40' W. had wind blowing very hard from N. N. W. and high cross seas from several directions. Barometer 29,60.

The center is fixed approximately by the "R. M. Walls" in latitude 27° 50' W. longitude 75° 59' N. At 1.30 A. M. the gale seemed to be at its height, barometer 29,18 wind about N. It suddenly died out leaving the vessel wallowing in a heavy cross sea.

On the 18th the storm passed over the ship "Stephen Hart" on her way from New York to New Orleans. At 1 A. M. of this day the wind suddenly died out having previously blown a hurricane from east. After half an honr of calm the wind came out from north blowing as strong as before and causing a heavy and dangerous cross sea. Barometer fell to 28,90, latitude 30° 10', long 75° 20' west.

The accounts received show that the storm continued in a northeasterly direction and was last reported on the 21st when the area of low pressures was north west of Ireland.

NEW ENGLAND METEOROLOGICAL SOCIETY.

The first annual meeting of this society was held in Boston on Tuesday, Oct. 21. It was preceded by a meeting of the council, at which certain details of business were arranged, and opened by a brief report from the secretary on the work thus far accomplished. The chief results announced were the formulation of plans, as described below, and the enlistment of about sixty new members who were duly elected. The officers under whom the society was organized (see this JOURNAL, August, 1884,) were re-elected, and the general discussions of the meeting were then introduced by the president, Prof. W. H. Niles, of the Massachusetts Institute of Technology, who spoke as follows:

The fact that the New England states share with other sections of the Union in the valuable results of the meteorological work of the United States Signal Service cannot be considered an excuse for not maintaining a meteorological

society. The work of the Signal Service is necessarily general in its application, and its stations are usually widely separated. Within the broad areas which it recognizes there are divisions, each having its peculiar weather and climate. Our New England section with its exposed position and its diversified surface, presents a marked variety of meteorological conditions. While we know that such diversity does exist, we do not know to what extent the climate of one region is distinct from that of another, much less do we understand the causes of certain peculiarities of our local climate. When this society had its inception in the minds of a few gentlemen who had gathered for conference, it was evident to each that there was no lack of opportunity for work which should add to our knowledge and increase the usefulness of that we already have. The chief question for discussion was what portion of the opportunity can such a society improve. It was justly feared that, should the society attempt several distinct lines of study at once, the observations would be imperfectly made or be soon neglected. Also the selection must be made partly with regard to the limited time voluntary observers can give. But two subjects have, therefore, been chosen for our initial observations and these are maximum and minimum temperatures and rainfall. While these observations will require but a small amount of the time of the observers, the results will nevertheless be valuable.

Extreme and sudden variations of temperature constitute a conspicuous feature of our New England climate, but the reports we incidentally receive from different districts are usually without scientific value. With good self-registering maximum and minimum thermometers properly distributed and located, the observed readings collected and collated by the director of observations and published in the *Monthly Bulletin* of the society, we may make a decided advance in our knowledge of the temperatures of New England districts.

The subject of rainfall has many relations of practical as well as of scientific importance. Superabundance of rain in one region and extreme drought in another is not an uncommon phenomenon. Daily observations with satisfactory instruments properly placed at many localities will be sure to yield data for a far better understanding of this important factor of our climate. Mindful of the importance of this subject, one of the first acts of the council was the appointment of a committee to determine the patterns of rain-gauge which can be adopted and recommended by the society. That committee is prepared to report at this meeting.

The following is an abstract of the report of the committee, presented by Mr. Desmond FitzGerald, M. Am. Soc. C. E., of the Boston Waterworks:

So many calculations are based upon the recorded rainfall of a given locality that it is of the greatest importance that wherever measurements are made they should be made accurately. The recommending of accurate gauges, and the bringing about some uniform methods of location and observation, is a part of the work to which the New England Meteorological Society has addressed itself. Out of many gauges examined by the speaker during the past five years, few have been found to be properly exposed. Some are placed so near to buildings that a large amount of rain is blown into the gauge; others are placed either too high, or not high enough above the surface of the earth. Then there is the greatest diversity in the gauges themselves. For instances, there is no uniformity of diameter (a minor point, to be sure); then many are inaccurate in the receiving-ring; others are made of improper material, while almost all are too shallow, permitting much spattering, and being entirely unfit to hold snow.

A number of gauges were exhibited, illustrating the several points in which serious error is liable to attend the use of ordinary gauges. Three gauges have been manufactured under the direction of the society, after an expenditure of much time and thought by a committee of the society, consisting of E. B. Weston, M. Am. Soc. C. E., Professor Winslow Upton, of Brown University, and the speaker.

These gauges are made of heavy copper, with very accurately turned brass rims. The largest one (No. 1) is 14.85 inches in diameter. In this gauge 100 ounces are equivalent to one inch of rainfall, and the water is weighed on a scale specially made for the purpose, the arm being graduated so as to read to inches and decimals of an inch. The smaller gauges are eight inches in diameter. In No. 2 the rain collected is transferred to a smaller tube, 2.55 inches in diameter, and measured with a stick in the ordinary manner. In No. 3 a shorter tube is permanently attached to the gauge. All of the gauges are very deep, to serve for the collection of snow as well as rain, and special provision is made to avoid loss by evaporation.

Allusion was made to the extensive experiments now being conducted at Chestnut Hill reservoir, Boston, under a variety of circumstances. In order to examine the influence of height on precipitation, gauges have been placed upon towers built for the purpose, the highest being sixty feet above the surface of the ground. The speaker called attention to the importance of permanent locations for gauges, in order that long series of observations may be made under the same conditions; also, to the impossibility of drawing any conclusions as to the permanent increase or decrease of the annual rainfall. The speaker closed by urging all the members to use their influence to establish accurate instruments, and to see that they are accurately observed.

Capt. J. C. Delano, of New Bedford, made a few remarks on the rain measures taken by himself from a gauge about thirty feet above the ground, and by a neighbor from a gauge close to the grass; the results were generally accordant in quiet rains, but differed in rains collected while the wind was blowing.

A paper on *Rainfall Maps* was then read by Mr. W. M. Davis of Harvard College.

The speaker exhibited a number of rainfall maps of different countries and states, executed in different styles, in order to show the various ends to be attained by one branch of the society's work, and to illustrate some of the objects of rain observation. The general climatic relations thus revealed make an important chapter in physical geography; Schott's winter and summer maps of the United States give excellent examples, such as the annual migration of the rains on our western coast in obedience to the shifting of the wind system north and south after the sun, as well as other familiar illustrations. A more practical and immediate application of rain measures is seen in such engineering projects as the establishment of city water-supplies and the drainage of waste swamp-lands, to convert them into arable fields. In selecting the site for a reservoir, it is essential to know the average annual rainfall of the district, its distribution in different seasons, and its probable variation from year to year, especially its minimum amount. In determining the size of a drainage-channel for a swamp, the maximum amount is of more importance, as is seen in a recent study of Tonawanda Swamp in Western New York, which it is proposed to drain. Approximate

answers to such practical questions can be obtained from maps and their accompanying tables, especially when they are of such detail and accuracy as those of Austria, lately prepared by von Sonklar for Chavanne's *Physical Atlas* of that country; but maps are seldom of sufficiently large scale for this purpose. The increase of precision obtained by increase of scale was illustrated by a series beginning with Professor Loomis' two maps of the world published a few years ago in his *Contributions to Meteorology*, followed by the annual and monthly maps of the United States issued by the Signal Service, and ending in the monthly maps for single states prepared by the various local weather services—these last are examples of what the New England Society hopes to produce; and to this end it is essential that all present members should be active in securing additional observers till nearly all our towns are represented. Great Britain and Ireland now have over 2100 observers, as announced in Mr. Symons' recent annuals on *British Rainfall*. We must endeavor to acquire a corresponding number of stations.

A distinctly different class of rain maps includes those that exhibit the relation of precipitation as an effect to the general atmospheric circulation as a cause; the charts compiled by Mühry and Woeikoff, and the still more complicated one in Stieler's *Hand Atlas* are examples of this kind. These have their best use in teaching. All the foregoing charts deal with summaries or averages for months, seasons or years, and so necessarily lose sight of the individual peculiarities of the separate storms that bring the rain. The individual study of the larger storms is attempted by the various weather services, which have greatly increased our knowledge of them, as may be learned by studying a series of daily weather maps; but the smaller local storms have as yet been but seldom examined in this way. The meteorological atlases of the observatory at Paris are noteworthy for the tracks of thunder-storms thus charted; but they give only the velocity and direction of the storm's advance, and yield no clue to the mechanism of its winds. Studies of more detail have been undertaken in Bavaria; and the state service that attempts similar work here with a sufficient number of observers will open the way to the solution of a most interesting and as yet unsolved problem. For this purpose, records of beginning and ending of rain are important, and if accompanied by the direction of wind, are much increased in value. It will be of interest to note a year hence how far our society shall have contributed to these various ends.

The third paper of the meeting was by Prof. Winslow Upton, of Brown University, on *Weather Observers in New England*, of which an abstract is here given.

In this country there are preserved many old meteorological records, beginning in some cases in the eighteenth century. A few of these are continuous, though breaks in the series are not infrequent. It is probable that in nearly all the cities and towns in New England there are to-day persons who keep some sort of a meteorological record for their own amusement, if for no higher motive. While this work is creditable, it is done at a considerable waste of energy, because there is no uniform method of observation in use, and because so few attempts are made to derive results from the accumulated material. Meteorological records are of use for studies in climatology and in the laws of atmospheric movements.

Considerable work in climatology has already been done in this country, though mostly of a general nature on account of the imperfect character of the data at hand. Reference may be made to *Blodget's Climatology* and to Mr. Schott's papers in the *Smithsonian Contributions to Knowledge*. The U. S. Signal Service has issued several climatological papers based upon observations made since 1870.

Many instructive examples could be given to show what has already been learned, and in what respects the data are defective. Thus, compare the curves of mean annual temperature as given by Schott and by Blodget, and also the curves of annual rainfall as deduced by Schott and by Dunwoody in the Signal Service publications. [Charts illustrating these comparisons were and shown explained.] It will be seen at once that important discrepancies exist which ought to be removed by further investigation. Many questions also arise, such as secular changes in temperature and rainfall which the accumulated observations cannot decide.

It may be asked whether further results can be obtained from past records or if more observations are needed. While it is doubtless true that all the results obtainable from the old records have not been derived, yet the attempts already made to derive results from them have brought into prominence their defects and show where improvements should be made. They show the need not simply of more observations, but of observations which have a higher grade of accuracy. In order to secure better results than those now possible from existing records, we should try to introduce more uniformity in instruments and in methods of observation, otherwise we simply accumulate observations from which little more can be derived than is already known. It is also advisable to set before ourselves definite objects of study, in order to prevent the mere aimless recording of "weather" phenomena. An increased interest in the subject will also remove the impression that the work of observing has no higher utility than the gratification of a temporary curiosity.

New England is an especially good field for meteorological studies on account of its physical features. It has coast and mountain climate combined. From its situation, at the eastern limit of the country, it furnishes opportunities for the minute study of atmospheric movements, which come to us from the west already well developed, and with their general features known from western observations. Our society has an ample field for doing good work in meteorology.

Prof. Arthur Searle, of the Harvard College Observatory, added a few words on the difficulty of maintaining long continued, unbroken series of observations, unless at specially appointed observatories; and on the importance of making up for the rarity of long records by the establishment of numerous stations.

The last paper of the afternoon was by Mr. A. Lawrence Rotch, S. B., of Boston, on the *Establishment of a Meteorological Station on Blue Hill, Mass.*, at the conclusion of which the speaker stated that he would be glad to learn of some one, already somewhat practiced in observation and interested in the study of meteorology, who would perform the duties of assistant observer at his station.

The Blue Hills, situated in Norfolk county, Massachusetts, are the nearest mountain range to Boston, and, though they are not in reality high, the fact that the surrounding country is low makes the range count for its full height. Great Blue Hill, the highest of the range, has an elevation of six hundred and thirty-five feet, and is not only the highest land in eastern Massachusetts, but is also the highest point on the Atlantic coast from Maine to Florida. As Great Blue Hill exceeds the other summits of the range by more than a hundred feet, it possesses the characteristics of an isolated peak, commanding an unbroken view of the

horizon with a radius of twenty-five miles. These features render it valuable as a site for a meteorological station, to investigate the rainfall at this elevation, the velocity and direction of the wind, the maximum and minimum temperatures, the paths of thunder and other local storms, and such other phenomena as may present themselves. It has been suggested that atmospheric electricity could well be studied here, and for seismometric apparatus the situation of the station would secure absolute freedom from the jar and vibration incident to the passage of neighboring trains and vehicles.

The hill is easily accessible, as from Readville, reached in half an hour from Boston by two railroads, it is only a mile and a half to the base of the hill, whence the writer has constructed a carriage road three-quarters of a mile long to the summit, having an average grade of but one foot in ten. The top of the hill comprises several acres nearly cleared of trees. Rising fifteen or twenty feet above the general level of the ground is a rocky ledge, and here, on the boundary line of the towns of Milton and Canton, the speaker is erecting a one-story stone building about twenty by thirty-five feet, containing five rooms, with a two-story tower fifteen feet in diameter and twenty-five feet high, to contain the instruments. A wooden shed adjoins the building. The tower stands upon the ruins of a look-out, or observatory, erected nearly a hundred years ago, and also covers the site of the copper bolt located by Simeon Borden for the State Survey, some fifty years back. There being no water upon the summit the rain falling upon the roof of the building will be stored in a cistern. The building will be securely anchored, will have double windows, and be heated by stoves, so that, it is hoped, it can be kept comfortable during the winter. It is intended to have two observers connected with the station and also a cook or steward. It is proposed to connect this station by telephone with the United States Signal Station in Boston, which is distant ten and one-half miles in an air line. The station is to be equipped, as far as possible, with self-recording instruments. Through the kindness of Mr. Fitz Gerald, of the Boston Waterworks, permission has been obtained to duplicate his ingenious self-recording rain-gauge in use at the Chestnut Hill Reservoir, and on account of the satisfaction given by Professor Draper's instruments at Providence, R. I., it is probable that his recording anemometer and anemoscope, at least, will be adopted at Blue Hill. Work on the station building is being pushed as fast as the weather permits, and it is hoped to have it ready for occupancy by the first of the year. The cost of the building, exclusive of instruments and furniture, will be about thirty-five hundred dollars.

The next regular meeting of the society will be held on Tuesday, Jan. 20, 1885, at a place yet to be named.

THERMOMETER EXPOSURE.

In *Science*, No. 58, p. 306, under the title of "A Question of Exposure," Professor T. C. Mendenhall of the Ohio State University, director of the State Weather Service, points out some rather startling discrepancies between the minimum temperatures during the remarkable cold snaps of last January, as determined by the Signal Service stations and those of the State. The most marked differences were on the nights of Jan. 21—when the mean of more

than twenty State Service stations gave a mean 12°.4 Fah. lower than the four Signal Service stations—and of the 25th, when the same means differed by 14°.7. On the same nights the lowest individual station temperatures of the two services differed by 27°.3 and 18°.9 respectively.

In view of these remarkable differences, a paper by Mr. H. A. Hazen of the Signal Office, published in the *American Journal of Science* for May, 1884, under the title of "Thermometer Exposure," has more than a passing interest, and a careful perusal of the paper has suggested the remarks which follow.

Mr. Hazen divides the question of exposure into two parts:

1st. The locality in any large region which will give the true average temperature and hygrometric condition of the atmosphere for that region; and,

2nd. The immediate environment of the thermometers which will ensure the same result.

In the first division he enumerates the conditions of height above ground, proximity of trees or houses, freedom of access of air, absence of local heat effects, character of ground, etc.; and the second division is devoted entirely to the different kinds of screens, shelters, or cages in which the thermometers are exposed.

Considering the comparatively small differences of the results from the different kinds of shelters employed, compared with the remarkable differences pointed out in Professor Mendenhall's paper as due to other conditions of exposure, it would seem that, if there are to be but two great divisions of these conditions, the first should comprise the questions of city and country, hill and valley, proximity to seas, lakes, rivers and marshes and elevation above them, proximity to mountain ranges, direction of prevailing winds, etc.; and that the conditions enumerated by Mr. Hazen should all be placed in a second class as local modifications of the wider topographical conditions of the first. When it comes to differences of a single degree and tenths of a degree, then no doubt the particular construction of shelter becomes highly important, and it would be very desirable that some one particular pattern that can be shown to be excellent under all conditions should be universally employed; but, for the far greater differences brought about by other topographical and local conditions of exposure, the shelter may be considered a part of the instruments themselves, and the question of *its* exposure is the important point.

Certainly the difference, pointed out by Professor Mendenhall, of 27° Fah. between the minimum temperatures in Columbus on the night of Jan. 21, as determined by the Signal Service and State Weather Service stations in that city (the Signal Service thermometers being exposed on the north side of a stone building and those of the State Service in the open ground of the University Campus about three miles distant), affords an emphatic illustration of the fact that thermometers near the walls of a stone or brick building cannot give the minimum temperature of any night, especially in cold, still weather and when the building is artificially heated. This circumstance must vitiate to some extent all temperatures taken anywhere in a city, or to the leeward of it when a moderate breeze is blowing. Doubtless in calm, still nights the atmospheric conditions in large open parks in cities would not differ very much from those in the open country, but these occasions would be exceptional.

On the other hand it may be questioned whether exposure near the ground, where the conditions of radiation and of evaporation or condensation, and consequent temperature, must vary considerably with the local character of the surface, can be relied upon as a measure of the average condition of the atmosphere for a few hundred or a few thousand feet overhead, especially in valleys and hollows when the air is quiet. On this point it would seem that experiments on high open scaffoldings, more complete than those of Professor Wild referred to by Mr. Hazen, would be highly desirable. We understand that Mr. Hazen is contemplating some such investigation, but, in order to be complete and effective, it should take a much wider range than can be carried out by a single observer. It should comprise series of *simultaneous* observations on high scaffoldings suitably distributed over some such large area as the State of Ohio, on hill and in valley, near lake and mountain, in summer and winter, by night and day, in dry and moist air, in calm and high wind, in order to determine whether there are any systematic differences, under all these different conditions, in the state of the air near the ground and a hundred feet above it, which would be sufficiently constant to admit of systematic correction of surface observations, or whether these differences are so irregular and of such amount as to justify the erection of permanent high scaffoldings for Signal Service stations, in order to get nearer the average condition of the air for some hundreds of feet above us.

Such an investigation, if properly carried out, would at the same

time settle the question of the best localities in such a large region for the permanent stations of the Signal Service, probably furnishing some general rules which would be applicable in almost any region; and it would throw new light upon all the conditions most favorable for producing the early or late frosts in low valleys, the prediction of which is of such importance to the agricultural interests in many sections of the country.

Certainly, if any meteorological stations need to be free from local peculiarities, it is those of the Signal Service which is engaged in predicting the general weather conditions for large areas; and it may be regarded as almost certain that many of its stations, selected at the outset in the middle of large cities for business convenience, will have to be moved into the country, and probably to moderately elevated points, before the best results can be attained.

Bearing upon the question of different atmospheric conditions at different points in the same city, Mr. Hazen gives the results of some series of observations of dry and wet bulb thermometers taken at successive street corners in Washington, over a line reaching a little more than a mile from the Signal Office. These show a considerable difference of temperature and humidity within this limited area, but the observations would carry greater weight if they had been carried *forward and back* over the same ground to eliminate the effect of changing temperature and evaporation and show just how much was due to this cause. Probably this will have been done in the further experiments there alluded to.

For the measurement of temperature and humidity from place to place, and also to compare these conditions on the outside with those inside the ordinary thermometer shelters, Mr. Hazen describes a method of exposing dry and wet bulb thermometers on a *fronde* or sling which is swung round the head in the open air. The wet bulb with its enclosing wick is lashed about two inches lower than the dry, so that it can be dipped into a bottle of water without wetting the dry. The temperatures determined in this way may possibly be vitiated in two ways, friction with the air tending to elevate the temperature and centrifugal inertia to depress the column, the latter, however, being probably only a temporary derangement while swinging, and the friction effect very slight. On this point Mr. Hazen remarks: "Repeated experiments at high "and low velocities (3 and 18 miles per hour) have invariably "given the same results, showing that these causes do not produce "harmful effects at any velocities possible by hand."

As to whether the above remark applies to the wet bulb as well as the dry Mr. Hazen is not explicit, and this is an important point for careful experiment; for it certainly cannot be assumed *a priori* that the rapidity of evaporation will not vary with the velocity of swing, though the increase may be slight beyond a moderate velocity. In the ordinary way of exposing the wet bulb in shelters, it is almost certain that, in a perfect calm, the air in the immediate vicinity of the wet bulb and wick, and to some extent in the whole shelter, will become somewhat overcharged with the evaporating water and hence show too high a percentage of humidity. This is quite forcibly shown by the results of Mr. Hazen's comparisons of the simultaneous readings of wet and dry bulbs exposed in two different kinds of shelters and upon the swinging *fronde* in open air at the same place. These results are given in Table V, p. 376, of Mr. Hazen's paper, and, after throwing out the cases where, in the shelters below the freezing point, the wet bulb read higher than the dry, they show in the Russian screen, which is badly ventilated, an average relative humidity sixteen per cent. higher than the *fronde* swung in open air, and, in one of the best shelters in use, an average of over seven per cent. higher than the same. These were all at low temperatures, some below the freezing point, where good ventilation is most needed.

In Table IV on the preceding page of his paper Mr. Hazen gives the results of an extensive series of comparisons of the temperature and relative humidity in three different kinds of shelters, the comparisons extending over eighteen days and the number of readings of each thermometer averaging sixty-five per day. The mean results show that, as far as temperature is concerned, there is not much difference in the three shelters, the extreme range of difference not exceeding 0°.5 F. In relative humidity there is more difference, the extreme range in the means being 3.0 per cent. and the Russian screen giving an average result 1.8 per cent higher than the mean of the other two. All these observations were at temperatures well above the freezing point; and, while we should not expect, at these temperatures, such large differences of humidity between the results of thermometers swung in open air and those exposed in shelters as were shown at the low temperatures noted above, yet it seems a pity that a part of the energy expended upon observations in these three shelters (more than 7,000 readings were taken to furnish the results of Table IV) should not have been employed by Mr. Hazen in twirling his thermometer *fronde* under some suitable shelter at

the same time and place, in order to test this method of measuring the humidity under all possible conditions of the atmosphere.

It seems almost self-evident that the ordinary plan of exposing the wet bulb thermometer must, to some extent, vitiate the very condition of the air which it seeks to determine, and that a correct measure of the amount of vapor of water present can only be obtained when the air is changed as rapidly as possible round the wet bulb where the evaporation is going on. The simplest way of accomplishing this is to swing the thermometers rapidly through a large mass of air, and this method of exposing wet and dry bulbs demands the most thorough investigation under all possible atmospheric conditions and with various kinds of shelter and exposure, in order to determine to what errors and uncertainties it is liable and the best way of avoiding or eliminating them. The question of proper shelter from direct radiation, both from the sun and ground and to the sky, becomes more difficult in this case (for the observer and all the air through which he swings his thermometers must be thus sheltered), and the possible effect of radiation from the observer's body before the readings can be made, especially in cold weather, should receive careful attention; but none of these difficulties are likely to prove insurmountable.

On the whole it may be said that all investigation points to a probable state of things in which the meteorological observer of the future, particularly he of the Signal Service type who seeks the average condition of the atmosphere over large areas, will be an individual of more active physical habits, whose frequent climbing of tall scaffoldings and whirling of thermometer slings will call for a greater expenditure of energy than falls to his present lot.

The rest of Mr. Hazen's paper is devoted to an investigation of the comparative temperature and humidity in different kinds of shelters placed side by side, and also of the temperature in different parts of the same shelter. In the latter case nine thermometers were hung at equal distances in a row in a "Pattern" shelter four feet long, and were observed at different times of day when the sun shone on different sides of the shelter.

Both these investigations are elaborate and involve a very large number of observations. A careful examination of the results would seem to warrant some conclusions of importance, to which Mr. Hazen does not call attention. A complete discussion of the data for these conclusions is deferred for more thorough examination, but their substance is this: that two independent features of

the results seem to show that the temperatures in all the shelters, especially the single-louvred wooden ones, are somewhat too high when the mid-day sun is shining on them, and perhaps too low at night when radiation to the sky is going on. This is shown to some extent in the results of Table V referred to above, where the *fronde* temperatures are compared with those in the Russian and Pattern shelters, although all these temperatures were down near the freezing point. If there is a real difference due to this cause, it would naturally be more marked at the high summer temperatures, and for this reason, as well as to measure the humidity under the same conditions, it would be interesting to see comparisons of the *fronde* and shelter temperatures under all possible conditions.

The other feature of the results pointing to the same conclusion is the marked constancy with which, in the results of Table III, the blackened bulb thermometers read higher than the dry in all the shelters, but especially near mid-day and in the Stow and Pattern shelters where the bulbs were exposed to direct radiation from the single louvred sides. If the blackening of the bulbs, thus rendering them more absorptive of radiant energy, will make this *difference* between black and dry bulb temperatures, it is not unreasonable to suppose that the *absolute* effect upon the dry bulb is also appreciable and that all the temperatures are somewhat too high under these conditions.

For this same reason it would have been interesting, in the case of the nine thermometers in one shelter (where such a decided increase of temperature was noted towards the side on which the sun was shining), to have had a number of blackened bulbs also symmetrically disposed with them, and to have made simultaneous readings upon them. Doubtless many of these interesting points will have been noted and carefully investigated in Mr. Hazen's further observations.

All these differences of temperature are small, ranging mostly inside two or three degrees and frequently only in the fractions of a single degree Fah., but the whole investigation is highly important as showing the difficulties in the way of getting at the exact temperature of the atmosphere, and more especially the discrepancies in determining its humidity. Mr. Hazen is to be highly commended for this very elaborate investigation and for the large mass of data placed at the disposal of meteorologists for discussion.

Certainly the picture of an observer standing upon ladders above the house-tops day after day, making readings of thermometers

whose number must mount into the tens of thousands, and also whirling his thermometer *fronde* up and down the street corners of Washington, affords an instance of enthusiasm and perseverance rarely to be met with among meteorological or other observers; and it is a pity that such energy cannot be multiplied a score of times and distributed by the Signal Service over a large area to carry out some such investigation as that referred to in the first part of this note. For, in these discrepancies due to varying topographical surroundings, we are dealing with whole *tens* of degrees instead of the *tenths* involved in different kinds of shelters, and it is certainly most important to attack the large sources of error first.

Such an investigation, however, cannot be carried on by any single observer, however enthusiastic he may be, but only by a large number of well-trained men, carrying out a well-planned, comprehensive, systematic series of simultaneous observations. It would probably involve an outlay of money too great for any but the general government to assume; but no more important investigation could be undertaken by the Signal Service for advancing a knowledge of exact meteorological science as concerned in the prediction of the general weather conditions over large areas, and this is the peculiar and special work for which the Service exists, at least as far as meteorology is concerned.

In conclusion perhaps, it will not be out of place to say a word regarding the methods of reducing and discussing meteorological observations. Such investigations as that of Mr. Hazen indicate that meteorology is coming to be, at least as far as observation is concerned, more and more of an exact science; and the methods of reduction should keep pace with observation. Nothing has helped more to place astronomy and geodesy far in the van of all the exact sciences whose data depend upon observation than the universal application, during the last half century, of the *method of least squares* to the rigorous discussion of all observations from which important constants are deduced; and the application of this method may justly be called the criterion or touchstone whereby we shall admit and reject the claim of any science to the title exact. In fact it is the only sure means of estimating the degree of accuracy attained in any series of observations, and, when such series has been so arranged as to eliminate all suspicion of *constant* error, then the *probable errors* of the resulting quantities are at once a measure of that accuracy, and they show at a glance the degree of confidence to be placed in the results and the proper weight to use

in combining them with others. Moreover, they show what parts of the work are weak and what strong, point out where further observations or improved methods are needed, and indicate when we are reaching the highest degree of accuracy attainable by any particular method. Better far a few observations, well planned to eliminate constant errors, carefully executed, and then thoroughly discussed so as to show the resulting probable errors, than any number whatever made without plan, taking an indiscriminate mean of the whole. The results in the first case bear upon their face the stamp of their intrinsic worth, whatever it may be; in the latter they may mean much, or they may mean little or nothing, there is no way of telling without a complete re-discussion.

True it is that this increases vastly the work of reduction; but just here is where work can be put in to the best advantage, drudgery though it may be. Very little real and solid advancement is made to-day in any branch of science without this, and as for the drudgery of long laborious computations to reach the highest degree of precision attainable in a few results, very few outside the computers in astronomy and geodesy know what the word means.

These remarks will apply as well to many investigations in other branches of science—physics, chemistry, etc.—as to meteorology, and the writer knows they will not come amiss even to some astronomers; but meteorological observations are so easily and rapidly made, that there is a much stronger temptation to multiply observations indiscriminately, and to shirk their rigorous reduction.

WASHINGTON, June 6, 1884. H. M. PAUL.

LOCAL WEATHER LORE.*

Weather Lore is peculiar to no particular people. No nation exists but what has some popular beliefs regarding weather signs. The ideas involved are as old as written history.

In Great Britain several works have been published on the subject of popular weather sayings, but in this country, with the exception of the little volume of "Weather Proverbs" by Lieut. Dunwoody, published by the Signal Service, I know of no publication.

Many curious sayings have been transported from Germany and Great Britain and have found a lodgement in America. Some of these still retain their original form and meaning. There are

* Read before the Section of Anthropology of the American Association for the Advancement of Science, at Philadelphia, September 5th, 1884.

others, however, which we can not appreciate, owing to the fact the idea is misapplied.

The advent of rapid and easy communication marks an epoch in the social life of the human race. We are upon the borders of two periods. The shadows of the superstitions of our fathers hang round about us as we are entering the period enlightened by scientific meteorology. The rapid increase in the knowledge of meteorology, together with sufficient means for its distribution, has materially changed many ideas in regard to the causes and forecasts of weather. With the age that is now passing away will be lost many of the quaint and curious sayings of the olden time. It behooves us, therefore, to apply ourselves that this much of the social history of our ancestors be not permitted to pass away with them. What would we not give had we an account of the folk lore of the different European nations for the last two centuries, to say nothing of the period before that. A half century hence much, which may now be preserved with little effort, will have gone forever. No doubt there are many proverbs which have become obsolete, and perhaps many more are rapidly approaching extinction.

The weather, no doubt, attracted the attention of men from the beginning of time. By continued watching certain real or fanciful relations between weather changes and various objects have been noted and arranged into popular form.

These proverbs form the basis of a peculiar system of meteorology which is now passing away.

Certain ideas in somewhat similar forms appear to be world wide. By far the greater number of proverbs, however, are of a local character, having only a local significance.

The study of "Weather Lore" is of twofold importance: First, its relation to established meteorological laws; second, its value considered from a sociological standpoint.

It is not the province of this paper to discuss the truth of any of these proverbs, but many of them will be found to be based upon principles which the most recent meteorological investigations have demonstrated to be true.

The proverbs of general distribution have been treated before. I shall therefore confine my attention to certain prognostics which I have collected from southeastern Indiana, most of which, I believe, have never been printed.

I have omitted entirely from this paper all proverbs I have found in Lieut. Dunwoody's article, but I have introduced some of the

ideas he has mentioned in different language from that in which they are presented by him.

The two branches of the White Water River meet at Brookville, forming an acute angle. One comes from the North and the other from the Northwest; after uniting, the river pursues a slightly southeastern course. The valleys are bordered by high hills, the greater portion of which are heavily wooded.

The warm southern currents are those which generally bring rain. From this fact we can easily understand the meaning of the following proverbs which are commonly used in the locality just mentioned: "When smoke goes up the stream it will soon rain;" or on foggy mornings is frequently heard: "When the fog goes up the river it will soon rain."

From these examples we can perceive the fact that even the most circumscribed areas have their effect in the production of weather proverbs.

A glance over some of the proverbs I have collected reveals many which are common in certain Southern States. Upon examination I find that the south half of Indiana was largely settled by people from the Southern States, as far north as upper Maryland and west into Kentucky, the greater portion of them coming from Maryland, Virginia, Kentucky and North Carolina. Mingled with the remaining proverbs of the old Southern stock I find many prognostics which suggest a Teutonic origin. Further investigation reveals the fact that in later years a wave of German emigration has swept over this part of the State and has left its impress upon the "Weather Lore" of this region.

Many proverbs are believed with religious devotion. This is especially true among the Germans. With the later generations of the English speaking people most of the proverbs of their ancestors are not only disbelieved, but many of them are forgotten.

To afford comparisons with the prognostics prevalent in other localities I have appended a list of the local sayings in regard to the weather:

Relating to the moon—"Circle round the moon, it will rain soon; circle round the sun, it will rain none." "When there is a halo 'round the moon, the number of stars visible within the circle indicate the number of days before it will rain."

Referring to fog and smoke are the two proverbs I have before mentioned—"When the fog goes up the river it will soon rain," and "When smoke goes up the stream it will soon rain."

Prognostics regarding clouds—"Cirrus clouds are known as rain seed, and indicate an approaching storm."

Regarding frost—"Three black frosts (in autumn) are followed by rain."

Regarding snow—"When snow comes from the East or Northeast, it indicates a deep snow." "Snow will remain on the ground a week for each day it remains on the limbs of the trees."

Proverbs relating to rain—"Red in the evening a sign of fair weather; red in the morning a sign of foul weather." A popular saying, which I am informed was much used in olden times at country parties when it was raining, is as follows: "More rain, more rest, kiss the girl you love the best." "More rain makes the grass grow."

Relating to lightning—"Lightning in the South indicates dry weather." "Lightning in the Northwest indicates rain within twelve hours."

Relating to wind—"When there is no wind it indicates foul weather."

Many proverbs are mentioned as referring to different animals. I give some of them: "When hogs and cattle manifest uneasiness, are restless, and are apparently seeking shelter, a change of weather is near." "A thick coat on fur-bearing animals indicates a long cold winter." "A well lined and well filled squirrel's nest indicates a severe winter." An old trapper has given me a few proverbs that were formerly in vogue when many of our now extinct animals were still found: "When beavers are very industrious, collecting their food early in autumn, it indicates a long, cold winter." "Deer are very playful before rain." "Foxes and wolves congregate and howl before a change of weather." "The otter, before a cold winter, lays up a large supply of food." Other proverbs taken from those collected relating to animals are as follows: "When hogs gather up sticks and carry them about expect cold weather." "Moles may be seen digging their passages industriously in all directions before rain."

Proverbs relating to birds—"Crows seen in winter indicate an early spring." "When snow-birds fly low, under the bushes, appear restless, and when they alight and erect their wings, it indicates cold weather; but when they frequent the top of bushes, are quiet, and do not appear to be seeking covert, expect fair weather." Ruffed Grouse drum more frequently before rain." "When turkey vultures are seen in winter it indicates warm weather soon."

Prognostics concerning insects—"When lightning-bugs appear in great numbers it indicates rain." "When flies congregate in the house expect rain soon."

Concerning trees—"When sycamore trees are very white in autumn expect a cold winter."

Concerning days—"If it rains on Easter it will rain for the next five Sundays." "No rain on Easter, no good oats crop." "A succession of warm days, followed by wind, will bring falling weather." "A white Christmas makes a green Easter."

Proverbs relating to months—"The first three days of March rule March, April and May." "A dry June never made a dear bushel of corn."

General prognostics—"When a pitcher of water sweats it will soon rain." "When a cellar becomes damp in summer expect rain." "Human hair curls before rain." "Artificial hair will not remain curled in wet weather." "When plastering or masonry is hard to dry, mechanics say it indicates rain."

I have now presented to you the greater part of the local prognostics I have collected. Some of the members of this association may wonder why such a paper should be presented. Many of us, I think, enjoy such papers because they are of a popular character, besides they treat of a long neglected branch of sociological study.

BROOKVILLE, IND., Sept. 1, 1884. A. W. BUTLER.

BRITISH EARTHQUAKES AND THEIR SEISMIC RELATIONS.

(ABSTRACT.[1])

In Mallet's "Catalogue of Earthquakes," 399 are recorded as having occurred in Great Britain between the years 1042 and 1842. This includes those occasions during which Comrie was shaken, thus making an average of about one for every two years.

The object of the present paper is to show that as many as 315 of these, or fully three-fourths, are more or less connected with a G. C.,[2] passing, from ever-active Stromboli and often-active Etna, through the pole of the land-hemisphere at Monte Rosa (Switzerland), skirting on its way the east coast of England, and traversing in its northerly course the middle of Scotland; thence reaching Iceland, and ultimately the North American volcanic region (Mts. Rainier, St. Helens, etc.,) near Puget Sound.

[1] Read at the Philadelphia meeting of the A. A. A. S., Sept., 1884.

[2] As in former papers presented to A. A. A. S., a great circle of the earth is here abbreviated to G. C.

The probability of this connection, the paper undertakes to prove, by giving the approximate seismic synchronism of other localities along that line, when Great Britain is agitated by earthquakes on its eastern border.

In order to make these facts more clear, the unabbreviated paper gives a synopsis of eight continuously active volcanoes (Sangay, Fogo, etc.,); fourteen of the best known remittingly active (Vesuvius, Etna, Bourbon, etc.,); eight or more prehistorically active localities, as proved by geological evidence (Eifel, Auvergne, etc.,), and eleven or more land areas, or volcanoes, suddenly elevated during the historical period, *e. g.*, Ullah Bund, in the Cutch, Jorullo, Monte Nuovo, and the like.

The paper then examines in detail the peculiar position of over forty places that are either noted for the frequency of their earthquakes, as Caracas, Lima, Scios, Smyrna, etc., or for earth tremors, sometimes continuing almost daily for months, such as occur at Comrie in Scotland, Janina in Epirns, Lunröe in Norway, Comorn in Hungary, etc.,—places usually found at the intersection of two seismic G. C's., and at the outcrop between two geological formations.

An additional object will be to show that the remaining 84 British earthquakes, of Mallet's catalogue for that period, were probably influenced by the passage through Great Britain, or proximity to its coasts of four other seismic G. C's. The tendency of seismic movements to follow G. C's. is shown in my paper on "Seismology," read at the Montreal meeting of A. A. A. S.;[3] also in a communication to the Sc. Am. Sup. (issue of March 29, 1884) when discussing the earthquakes of 1883. These G. C's. denote activity, along the belt, as often through evidences of upheaved as of depressed or fractured zones. In fact, whenever land is elevated there must be a consequent sinking at no great distance, either longitudinally or laterally—*e. g.*, the elevation of Europe and Asia necessitated the Caspian Sea depression, the rising in northern Norway and Sweden compelled the sinking of the coast of northwest Europe,[4] near the North Sea and South Baltic.

The unabridged paper gives, in detail, the topography and geology of those five G. C's., of which the following abstract may offer some idea:

1. The Azore-Asonoyama Belt.

[3] See vol. XXXI, part 2d, p. 330, *et seq.*, of Pro. A. A. A. S.
[4] See map at p. 326 of Reclus' "Earth."

Topography: A G. C., passing from the initial focus of land-forming in Norway,[5] and running thence S. 30° W. toward the N.W. coasts of Scotland and Ireland, coincides with the average parallel fissures, laid down by Prof. Evan Hopkins, C. E., on his map of Great Britain, as "*old* lamination of rocks, cleavage plane, etc."[6] It connects the volcanic Azores with the Vol. of Asonoyama and others in southern Japan; and, with the other radii from that Norwegian focus, aided in giving configuration to the Scandinavian Peninsula.

The *Geology* of this G. C. chiefly marks the junction between Archæan and Paleozoic, in Scotland,[7] Ireland, and the mountains of Brazil (Paleozoic).

2. The Orizaba-Ormuz Belt.

Topography: This G. C. which radiates N. 30° W. from Tatra, the geographical centre of Europe,[8] passes through Newcastle (on Tyne), the Isle of Man, the N. of Ireland, and reaches the region of Orizaba and other Mexican volcanoes; while, extended S. 30° E. from Tatra, besides passing through the extinct volcanic region of Armenia, and the oft-shaken towns of Persia, it reaches the volcanoes of the Persian Gulf. This G. C. accords, in passing through Great Britain, with Hopkins' average lines, marked "direction of *old* fractures;" they run across those of No. 1, at right angles.

Geology: The radii from Tatra, especially southeasterly along the Carpathians, and northwesterly through northern Bohemia (as well as southwesterly into Austria and northeasterly into Russia), mark Mesozoic, chiefly Cretaceous areas.

3. The Stromboli-Heckla or Etna-Heckla Belt—the most important of all.

Topography: It radiates from Rosa N. 30° W., through Belgium, E. England (Colchester, Lincoln, York marking the middle strand of the belt, which often has an area-width, each side, of about 75 English miles), through Perthshire in Scotland, and reaches Ireland. From Rosa S. 30° E., it passes near the western coast of Italy to the Lipari Islands, taking in Sicily and Calabria. The lines on Hopkins' map which correspond to this G. C. are marked as "'direction of *recent* cross courses and splits."

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[5] Vol. XXIX, part 2d, p. 441 of (Boston) Pro. A. A. A. S.

[6] "Hopkins' Geology," p. 61, *et seq.*, and map, Plate VI.

[7] Consult pp. 110 and 111 of "Geol. Sketches," by A. Geikie, Director British Geological Survey; also the map at p. 450 of his "Text Book."

[8] Pro. A. A. A. S., vol. XXIX, part 2d, p. 441, *et seq.*

Geology: Cenozoic, as it has mainly brought Tertiary to the surface in Sicily, along the flanks of the Apennines, at Berne, Bale, in Belgium, in Lincolnshire (England) and Yorkshire, even beyond Hull.

4. The Santorin-Colima Belt.

Topography: Emanating from Rosa N 60° W. this G. C. traverses France and the S. of England, to a point somewhat N. of the volcano of Colima, Mexico; running S. 60° E., it connects Janina with Santorin.

Geology: It marks the Tertiary of parts of Greece, Thessaly and Albania in Turkey, of Lombardy in Italy, of Dijon, Orleans, etc., in France.

5. The Fogo-Tangariro Belt.

Topography: This G. C. is that one of the five equidistant continental trends,[9] which, passing through Cook's Straits near the volcano Tangariro,[10] in New Zealand, skirts the eastern coast of South America, traverses the ever-active Fogo (Cape Verde Islands), the Canarses, the submarine volcanic area in the Atlantic, also the earthquake region of Lisbon, and is prolonged, through the Bay of Biscay, N. W. coast of France and Belgium, to Denmark, etc. It coincides, in its general trend, with the lines marked by Hopkins in his map as "the average direction of *most recent* fractures, lodes, etc."

Geology: Its geology is chiefly Cenozoic in the Cape Verde and Canary Islands, Valadolid (Spain), Valleys of Adour, Garonne and Seine (France) portions of Belgium, Holland and Denmark, marked on Sir R. Murchison's map of Europe as Miocene.

APPROXIMATE SYNCHRONISM.

To prove the synchronism, the unabridged paper enumerates more than 35 dates of English earthquakes, on these G. C's, corresponding with other seismic movements, simultaneous or of approximate synchronism, at places along the same line. In an abstract only a few examples can be given:

A. D. *Five Examples on G. C. No. 3.*

1186—Middle Sept., England, Calabria and Sicily.
1791—Oct. 28th, England; 29th, Sicily and Calabria.
1818—Feb. 20th, Lincolnshire, Calabria and Malta. [Etna quiet since 1811 until this date.]
1828—May 13th, Berne; 20th, Dumfries; 22d, Soleure.

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[9] Described in Pro. A. A. A. S., vol. XXIX, p. 339.
[10] Stated in Reclus' "Earth," p. 483, to be constantly active.

1834—Aug. 23, around Vesuvius; 24th, Perthshire; 27th, Chichester; Sept. 21st, Oct. 5th and Jan. 12th, 1835, Chichester; same date, Tuscany.

Three Examples on G. C. No. 1.

1826—Nov. 5th, Lunröe (Norway); 26th, Arran (Scotland).

1827—Feb. 9th, Anglesea and Wales generally; March 7th, Lunröe (shocks continued some months, at intervals).

1820—Jan. 20th, Lunröe; 22d, Perthshire and Dumbarton; April 2d, Lunröe; 6th and 11th, Cork (Ireland).

Five Examples on G. C. No. 2.

1134—Oct. 1st, England, the Netherlands and Armenia.

1666—Jan. 18th, Warrickshire and Hungary.

1683—Sept. 28th and Oct. 9th, England, especially Derbyshire; Nov. 27th, Erivan, and frontiers of Turkey and Persia.

1786—Aug. 11th, Newcastle, Lancaster, Whitehaven, Isle of Man, Dublin; 22d, Upper Silesia and Moravia.

1760—Jan. 20th, 7 P. M., Wicklow in Ireland; 10¼ P. M., Amsterdam, Leyden and Utrecht.

Five Examples on G. C. No. 4.

1762—Jan. 11th, Seine and Oise, Estates of Church; March 14th and 15th, Tuscany; 16th and 20th, Wexford in Ireland.

1573—Dec. 20th and 21st, Switzerland; 1574, Feb. 26th, Bristol; May 3d, Geneva.

1712—Aug. 11th, Valais (Switzerland) and Shropshire (England).

1755—Dec. 15th, 17th and 20th, Brieg in the Valais; 18th, Herefordshire (England).

1756—Jan. 1st, W. of Ireland and Brieg.

Four Examples on G. C. No. 5.

1580—April 6th, 6. P. M., London, Dover, all Kent, Boulogne, Calais, Brussels, Malines, Cologne, Holland, Zealand; most violent in England.

1671—Sept. 18th, English Channel, St, Malo, Havre, Calais, Dunkirk, Antwerp.

1734—Nov. 5th, Susex, Portsmouth, Chichester, Havre.

1750—March 19th and 20th, London; 25th, Surrey; 29th, Isle of Wight, Portsmouth, Southampton, also Jersey and Guernsey.

SUMMARY.

If the same ratio continues that existed during the above 800 years, four-fifths of all the British earthquakes may be expected to pass along the east coast of England, consequently along G. C. No. 3; and these might occur at any time when there is activity on the belt between Etna, Vesuvius and Heckla; but probably with less chance of disastrous results when Etna, Vesuvius and Heckla are active than when their closure directs the explosive activity to other parts of the G. C.

The earthquakes coincident with G. C. No. 4 would chiefly affect the S. W. of England.

When shocks are transmitted along G. C. No. 2, the E. and W. middle counties of England, and S. of Scotland, and N. of Ireland would be most liable to disturbance; while earthquakes along the belt No. 5, which marks South America's eastern continental trend, would chiefly disturb the southern counties of England.

RICHARD OWEN.

RECENT DISCOVERY OF THE TRUE SOURCE OF THE MISSISSIPPI RIVER.

By Captain Willard Glazier.

CHAPTER V.

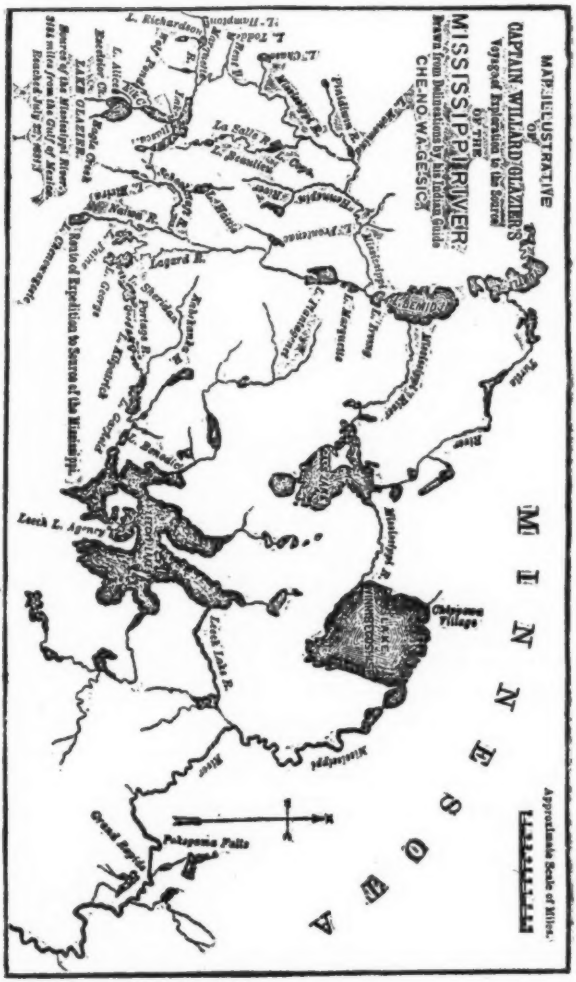
SOURCE OF THE MSSSISSIPPI.

The exhausting portages of July twenty-first between the east and west forks of the Mississippi prepared us for a sleep which even the Minnesota mosquitos could not disturb, and which was not broken until long after the sun was glinting upon us through the trees on the morning of the twenty-second. Although I had cautioned the guides to awaken me at dawn, I found them snoring lustily at six o'clock.

As soon as all were astir Che-no-wa-ge-sic and the Lagards prepared breakfast. George struck tents and rolled the blankets, while Paine busied himself with an article for the St. Paul *Pioneer Press*, descriptive of our voyage to Lake Itasca. But little ceremony was observed at breakfast, which was served with a due regard to our scant rations, and consisted of a small slice of bacon and a "flapjack," each of very meagre dimensions.

Notwithstanding the fact that we were now confronted with empty haversacks and depleted cartridge-boxes, my companions were still eager to follow my lead in the work of exploration beyond Itasca, which from the beginning had been the controlling incentive of our expedition, the grand objective towards which we bent all our energies. To stand at the source; to look upon the remotest rills and springs which contribute to the birth of the Great River of North America; to write *finis* in the volume opened by the renowned De Soto more than three hundred years ago, and in which Marquette, La Salle, Hennepin, Joliet, Beltrami, Nicolett and Schoolcraft have successively inscribed their names, was quite enough to revive the drooping spirits of the most depressed.

During our encampment on the island, Che-no-wa-ge-sic again reminded me that he had planted corn there many years before, and that his wigwam once stood near the spot where we had pitched our tents. He also repeated what he told me before launching the canoes at Leech Lake, that the region about Lake Itasca was his hunting-ground, and that he was thoroughly acquainted with all the rivers, lakes and ponds within a hundred miles. He further


MAP ILLUSTRATIVE
OF
CAPTAIN WILLARD GLAZIER'S
Voyage of Exploration to the Source
OF THE
MISSISSIPPI RIVER.
Drawn from Delineations by his Indian Guide
CHE-NO-WA-GESICK
MINNESOTA
Approximate Scale of Miles
Leech L. Agency
Chippewa Village
Pokegama Falls
Grand Rapids
Mississippi R.
Leech Lake R.
Route of Expedition to Source of the Mississippi

said that Paul Beaulieu was in error concerning the source of the Great River, and led me to conclude that the primal reservoir was above and beyond Itasca, and that this lake was simply an expansion of the Mississippi as is Bemidji, Cass, Winnibegoshish, Pepin, and several others.

Fully convinced that the statements of Che-no-wa-ge-sic were entirely trustworthy, and knowing from past experience that he was perfectly reliable as a guide, we put our canoes into the water at eight o'clock, and at once began coasting Itasca for its feeders. We found the outlets of six small streams, two having well defined mouths, and four filtering into the lake through bogs. The upper end of the southwestern arm is heavily margined with rushes and swamp-grass, and it was not without considerable difficulty that we forced our way through this barrier into the larger of the two open streams which flow into this end of the lake.

Although perfectly familiar with the topography of the country, and entirely confident that he could lead us to the beautiful lake which he had so often described, Che-no-wa-ge-sic was for some moments greatly disturbed by the net-work of rushes in which we found ourselves temporarily entangled. Leaping from his canoe, he pushed the rushes right and left with his paddle, and soon, to our great delight, threw up his hands and gave a characteristic "Chippewa yell," thereby signifying that he had found the object of his search. Returning, he seized the bow of my canoe, and pulled it after him through the rushes out into the clear glistening waters of the infant Mississippi, which at the point of entering Itasca is seven feet wide and about one foot deep.

Slow and sinuous progress of two hundred yards brought us to a blockade of logs and shallow water. Determined to float in my canoe upon the surface of the lake towards which we were paddling, I directed the guides to remove the obstructions, and continued to urge the canoes rapidly forward, although opposed by a strong and constantly increasing current. Sometimes we found it necessary to lift the canoes over logs, and occasionally to remove diminutive sand-bars from the bed of the stream with our paddles. As we neared the head of this primal section of the mighty river we could readily touch both shores with our hands at the same time, while the average depth of water in the channel did not exceed five inches.

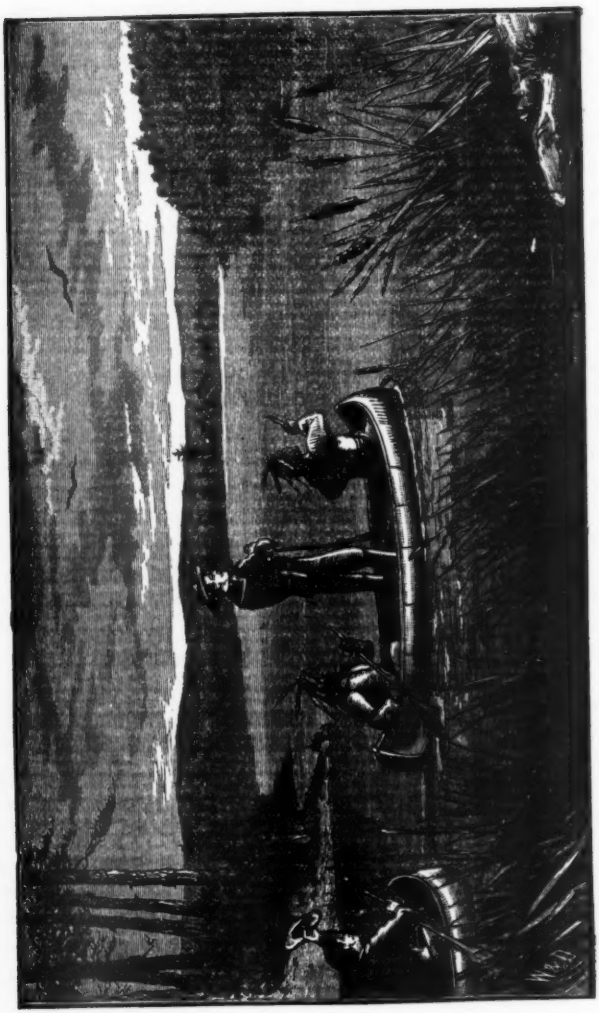
Every paddle stroke seemed to increase the ardor with which we were carried forward. The desire to see the actual source of a river so celebrated as the Mississippi, whose mouth had been reached by

La Salle nearly two centuries before, was doubtless the controlling incentive. In their eagerness to get a first glimpse of the glittering nymph we had been pursuing, and greatly annoyed by the slow progress made in the canoes, my brother and Paine stepped ashore and proposed a race to the crest of the hill which Che-no-wa-ge-sic told them overhung the lake. To this proposition of my companions I made objection, and insisted that all should see the goal of our voyage from the canoes. What had long been sought, at last appeared suddenly. On pulling and pushing our way through a net-work of rushes similar to the one encountered on leaving Itasca, the cheering sight of a transparent body of water burst upon our view. It was a beautiful lake—the source of the Father of Waters.

A few moments later and our little flotilla of three canoes was put in motion, headed for a small promontory which we discerned at the opposite end of the lake. We paddled slowly across one of the most pure and tranquil bodies of water of which it is possible to conceive. Not a breath of air was stirring. We halted frequently to scan its shores, and to run our eyes along the verdure-covered hills which enclose its basin. These elevations are at a distance of from three to four miles, and are covered chiefly with white pines intermingled with the cedar, spruce and tamerack. The beach is fringed with a mixed foliage of the evergreen species. At one point we observed pond lilies, and at another a small quantity of wild rice.

As we neared the headland a deer was seen standing on the shore, and an eagle swept over our heads with food for its young, which we soon discovered were lodged in the top of a tall pine. The waterfowl noticed upon the lake were apparently little disturbed by our presence, and seldom left the surface of the water.

This lake is about a mile and a half in greatest diameter, and would be nearly an oval in form but for a single promontory which extends its shores into the lake so as to give it in outline the appearance of a heart. Its feeders are three small creeks, two of which enter on the right and left of the headland, and have their origin in springs at the foot of sand-hills from two to three miles distant. The third inlet is but little more than a mile in length, has no clearly defined course, and is the outlet of a small lake situated in a marsh to the southwestward. These three creeks were named in the order of their discovery, Elk, Excelsior and Eagle. The small lake, which is the source of Elk Creek, I called Alice after my daughter.



SOURCE OF THE MISSISSIPPI.

Having satisfied myself as to its remotest feeders, I called my companions into line at the foot of the promontory which overlooks the lake, and talked for a few moments of the Mississippi and its explorers. Told them I was confident that we were looking upon the TRUE SOURCE of the Great River. That we had completed a work begun by De Soto in 1541, and corrected a geographical error of half a century's standing. Concluding my remarks, I requested a volley from their fire-arms for each member of the party, in commemoration of our achievement. When the firing ceased, Paine gave me a surprise by stepping to the front and proposing "that the newly discovered lake be named Lake Glazier, in honor of its discoverer." The proposition was seconded by Moses Lagard, the interpreter, and carried by acclamation.

Much to the surprise of every one, as we were about closing our ceremonies, Che-no-wa-ge-sic assumed an oratorical attitude, and addressed me as follows in a few words of true Indian eloquence: "My brother, I have come with you through many lakes and rivers to the head of the Father of Waters. The shores of this lake are my hunting-ground. Here I have had my wigwam and planted corn for many years. When I again roam through these forests and look on this lake source of the Great River I will look on you."

The latitude of this lake is 47° 13′ 25″. Its height above the sea is an object of geographical interest, which in the absence of actual survey it may subserve the purposes of useful inquiry to estimate. From notes taken during the ascent it cannot be less than three feet above Lake Itasca. Adding the estimate of 1575 feet submitted by Schoolcraft in 1832 as the elevation of that lake, the Mississippi may be said to originate in an altitude of 1578 feet above the Atlantic Ocean. Its length, taking former data as the basis, and computing through the western fork, may be placed at 3184 miles. Assuming that the barometrical height of its source is 1578 feet, it has a mean descent of over six inches per mile.

The highest northing attained by the Mississippi is in Lake Bemidji, which cannot vary but a few minutes from forty-seven degrees. Its origin in the remote and unfrequented region of country between Leech Lake and Red River, not less than an entire degree of latitude south of Turtle Lake, which was for many years regarded as the source, throws both forks of the stream out of the usual route of the fur-traders, and furnishes the best reason, perhaps, why its fountain head has remained so long enveloped in obscurity.

ADDENDUM.

Meteorological Observations at the Head-waters of the Mississippi.

	5 A. M.	7 A. M.	8 A. M.	12 M.	2 P. M.	8 P. M.	9 P. M.	REMARKS.
July 17	..	..	..	76°	80°	79°	78°	Morning rainy, then fair.
" 18	..	..	51°	64	66	53	50	Fair.
" 19	..	..	46	63	70	55	..	Night rainy, morning cloudy, then fair.
" 20	..	..	60	80	84	75	..	
" 21	..	..	68	86	88	85	74	
" 22	..	..	73	88	90	77	..	Cloudy, some thunder.
" 23	..	..	70	82	88	78	..	Night and morning rain, afternoon thunder.
" 24	..	..	74	87	80	78	..	Fair.
" 25	..	..	..	..	85	74	..	Fair.
" 26	61°	..	..	..	81	61	..	Morning fair, evening cloudy and rain, clear.
" 27	62	..	..	..	80	75	..	Morning fair, evening fair.
" 28	62	..	..	..	76	61	..	Morning fair, rain in afternoon.
" 29	50	..	..	..	74	52	..	Clear.
" 30	..	60°	..	..	76	..	63	Wind N. W., weather clear.
" 31	..	65	..	..	81	..	69	Wind W., weather clear.
Aug. 1	..	67	..	..	83	70	..	Fair.
" 2	..	72	..	..	..	..	..	Fair.

DUST.*

A general meeting of the association was held in the Queen's Hall recently, when Prof. Oliver J. Lodge, D. Sc., professor of physics in University College, Liverpool, delivered a lecture on Dust. The president, Lord Rayleigh, occupied the chair, and in a few appropriate remarks introduced the lecturer of the evening. The lecture, which was a most interesting one, was illustrated by experiments under the superintendence of Mr. John Cottrell, of the Royal Institution of Cambridge, including the Aitkens experiment, showing that fog cannot be produced unless fine particles of dust are present; the experiment of dissipation of fine particles of dust by an electric discharge; Tyndall's experiment showing the action of a hot body on the floating matter of the air producing dark places, etc.

Prof. Lodge commenced by saying that the term dust was used as including smoke and water-dust or fog and mist, and as simply suspended foreign matter in the atmosphere of whatever kind. The

* A lecture by Prof. Lodge to the British Association for the Advancement of Science, taken from the *Montreal Gazette*.

air of Canada was surprisingly free from suspended dirt as compared with England, but it was not as free as it might be and if care was not taken as towns grew the atmosphere would get spoiled and polluted as had been done in England. Our locomotives caused almost as much smoke as a Clyde steamer, and the journey across the continent would be pleasanter if they emitted less. He also saw some factory chimneys rising here and there. If we were not warned in time we would not realize the blessing of fresh and pure air until we have lost it. It was good to have large manufactories; it was better to retain healthy and pure air. But with proper care the two might go together. Once lose ground in this respect, as they have done in England, and terribly uphill will be the retracement of our steps. The old country has in many things made experiments for us, experiments of which we may reap the benefit without repeating them, if we choose. He dare not, he continued, mention, except by name, the experiment of protection, which they in England had tried and abandoned, but he dare mention the experiment which they had tried only too successfully, and by no means yet abandoned, though they groaned under it, that of fouling the atmosphere wherever a large number of human beings have to live on it, to such an extent that it is not fit to breathe. They have made a terrible mistake and one that will take perhaps a century to undo. Tax all the necessities of life and it is a small evil, for the tax may, at any time, by act of parliament, be removed; but pollute the air in which a people have to live and no one can see the end of the evil. We would, he continued, soon have towns here rivalling Liverpool, Glasgow and Manchester in size, and, some day London, and we should be warned in time. The sources of dust were as the spray of the sea, the eruption of volcanoes and the fragments of meteors. Concerning meteoric dust the lecturer said that since it came to us from altogether extra terrestrial sources it is to us of the most intense interest. Our only other visitant from other worlds we knew of was light. Light was charged with information, though it took man many centuries to learn how to read it—first, with the telescope; then with the spectroscope, and next will be who shall say what still more powerful revealer and analyzer of hidden truth. Meteoric dust may not be so laden with information as light is; certainly we have not yet learned to read it; it was only written within the last few years. At the instigation of Sir Wm. Thomson, a committee of section A of the British Association was appointed to consider the question whether such

dust could be collected and detected at all. Under the able and energetic guidance of Dr. Schuster, it had done good work, and some dust from the ice-fields of the Himalayas and from Greenland had been definitely found to be meteoric. At present, however, no sign of organic matter or evidence of extra terrestrial life has yet been detected in it, but any year this statement may have to be modified and a discovery of the most intense interest and of the profoundest importance may have to be announced. We had probably all heard of this theory of Sir Wm. Thomson that some life germs may have been carried to the earth by a meteor, and we were probably equally well acquainted with the ridicule the statement met with at the hands of newspaper article writers and the general public. It was derided as an absurd attempt to explain the origin of life. It was nothing of the kind. Nothing at all was said about the origin of life; it was a sober matter of fact statement that it was a scientific possibility for some organic germs or seeds to be conveyed to the earth by a meteor, to be rubbed off it at its first entrance into the atmosphere without getting over-heated, and thence to settle down as dust and to germinate. Well, it was a possibility, and it may before now have happened, and it may happen again, and very interesting it would be to be able to point to a case of its happening. But what then? If we account for the presence of a cherry tree in our orchard by saying that it sprang from a cherry-stone dropped from a passing balloon, were we to be assailed as a full-blown explainer of the origin of all cherry trees and of all form of life. We may take it as a fairly safe rule that when a statement is made by the highest scientific authority living at any one time on this planet the statement may or may not be true, but it is not likely to be such abject nonsense that any newspaper article writerin the interval between ten o'clock and midnight can see all through it, can clear it out and serve it up exposed for our breakfast edification. It is one of the most important discoveries of this century that what we call an infectious disease is due to the growth of a specific vegetable organism in the system, just as yeast propagates itself in dough or ferments in alchoholic liquors. That the germs of these organisms float about in the air from place to place, planting themselves in such position that some are sure to enter the blood of some animal organism, say a man, where they may be able to grow and flourish, provided they are able to encounter their mortal foes, the white corpuscles of the blood. If these corpuscles are strong and vigorous, they will overpower the foreign growth and kill it; if, on

the other hand, they are weak and feeble and the germs are very numerous, the foreign growth may get a secure footing and spread luxuriantly, changing the character of the glands of the body, coagulating, it may be, the albumen and otherwise setting up the unnatural and abnormal display of functions which we call disease. The most powerful and rapid way of clearing air, continued the speaker, was by electrifying it, and it was shown how quickly a point discharge could clear air of thick smoke. Electrification of fog turns it into Scotch mist and rain, and this fact bore a close relation to the violence of thunder showers. A hope was expressed that fog might, perhaps, prove amenable to this treatment. In coming to this country some of the members of the association lay for some hours outside the Straits of Belle Isle in the midst of icebergs mingled with fog. Electric light is powerless to penetrate it, and it was impossible, as they lay there idle, not to be struck with the advisability of dissipating it. It was rash to predict what could be done; it was still rasher to predict what could not. He would merely point out that on board a steamer are engines; that these engines can drive a very powerful Holtz machine, one pole of which may be led to points on the masts. When electricity is discharged into fog on a small scale it coagulates into globules and falls as rain perhaps it will on a large scale, too. Oil stills the ripples of a pond and it has an effect on the ocean billows; just so an electric discharge, which certainly coagulates and precipitates a smoke or fog in a bell jar, may possibly have an effect on an Atlantic fog. He was not too sanguine, but it would not cost much to try, and even if it only kept a fairly clear space in front of the ship, it would be useful. There were other applications of this electrical clearing or deposition of dust, one of which he knew was being tried on a fairly large scale, but he was not here to talk of practical applications, but of science itself. A homely proverb might be paraphrased into a useful motto for young investigators, "Stick to the the pure science, and the applications will take care of themselves." He was not one to deny the application of science to the benefit of mankind, far from it, but while the rewards of industrial application were obvious and material and such as would always secure an adequate following, the rewards of the pursuit of science for its own sake, are transcendental and immaterial, and not to be imagined except by the few called to the work. That call entails labour and self-sacrifice beyond most other, but those who receive it will neglect it at their peril.

At the conclusion of the lecture, Sir William Dawson in a few appropriate words, moved a vote of thanks to Prof. Lodge for his interesting and valuable discourse.

The Rev. Father Perry seconded the motion, which was carried unanimously, and the meeting then adjourned.

SELF-RECORDING MERCURIAL BAROMETER.

I was led to construct this form of barometer from the fact that with the photographic one it connot be told what the atmospheric fluctuations are until the next morning, when the photographic plate is developed. Even then, if there has been much variation in temperature, it alters the sensitiveness of the collodion film, so that it is very difficult to read the tracing. The construction of the pencil instrument is as follows:

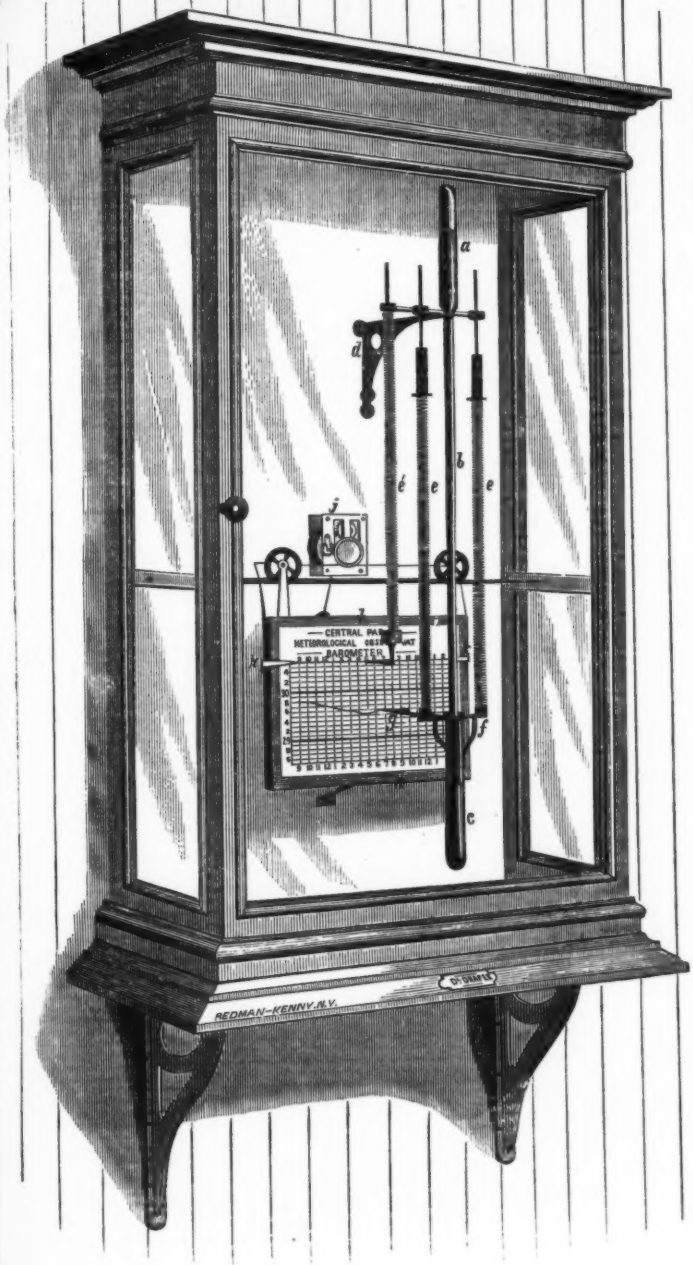
In the pencil barometer the glass tube is 36 inches in length, the upper portion being of larger diameter than the lower; it is held firmly in a fixed position, and filled in the usual manner with quicksilver; its lower or open end dips into a tube or reservoir containing the same metal. This reservoir is suspended on two spiral steel springs, and has freedom of motion up and down. When the pressure of the atmosphere diminishes, a portion of the mercury flows out of the tube into the reservoir; this becoming heavier, stretches the steel springs, causing the ink pencil fastened to them to mark downwards. If the pressure increases the reverse movement takes place. The ink pencil makes its mark on a ruled paper register, carried at the rate of half an inch per hour from right to left by a clock.

There is a third steel spring of the same length and strength as those on the reservoir, stretched by a weight to a distance equivalent to 30 inches on the barometer scale. The object of this spring is to give the correction of temperature for those sustaining the reservoir. The register paper should always be set to the same line on which the pencil of this spring marks.

The movements of the mercury on the register can be magnified to any required extent by increasing the length of the spiral springs. In this instrument it is multiplying twice.

DESCRIPTION OF INSTRUMENT.

The tube marked *a b* is of glass; the upper part is of a larger diameter than the stem, *a* being $\frac{1}{4}$ of an inch internal diameter and 10 inches long, while the stem, *b*, is $\frac{1}{8}$ of an inch bore and 26 inches long. The total length of the tube is therefore 36 inches. The reservoir, *c*, is suspended from a brass frame, *d*, fastened to the back of the case. This frame also holds the upper ends of the steel springs, *e*, *e*, *é*. The glass reservoir, *c*, is of the same diameter and length as the upper part of the tube, *a*; on its open end is turned a flange to hold it in a brass frame, *f*, to which are fastened the lower ends of the steel springs, *e*, *e*; it also carries an ink pencil, *g*, that touches the ruled paper on the board, *h h*, which is drawn aside by the clock, *i*. The spring, *é*, is for the correction of temperature on the



DRAPER'S SELF-RECORDING

MERCURIAL 'BAROMETER.

other springs. Heat has a slight effect on them, causing them to lengthen about $\frac{1}{16}$ of an inch for 90 degrees Fahr.; to allow for this, the third spring, *é*, is weighted with a lead weight and pencil, it marks its fluctuations on the upper line of the register sheet. In this manner this instrument gives the correction for temperature (or reduction to 32°) from the fact that it weighs the mercury instead of measuring its length, which is affected by heat.

Ink pencils of the barometer and other instruments are made by drawing narrow glass tubing to a fine point, which lightly touches the paper register, leaving a mark of red ink that has been diluted with about one quarter of its volume of glycerine. The glycerine prevents the ink from drying too rapidly. The advantage of this form of pencil over lead ones is that it requires little or no pressure to produce a mark.

To receive the atmospheric fluctuations a suitable ruled paper is fastened by means of small brass clamps, *k k*, to the board, *hh*, which is hung by rollers to the thick steel rod fastened to the sides of the case, on which the paper is carried from right to left by the clock, *i*, at the rate of $\frac{1}{2}$ an inch per hour, by means of the pulley on the hour arbor of the clock. The wire that connects the register board to the clock is soft steel, number 28 wire gauge; having only one turn round the pulley it readily slips so that the board can be pushed sideways for the adjustment of time, or for the renewal of the sheet of paper.

D. Draper.

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AN ILLUSTRATED MONTHLY

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LITERARY NOTES.

—We have before us a small meteorological annual. This is a 32mo. of 109 pages and is entitled *Almanacco Astronomico Meteorologico per l'anno 1884.* It is published at Verona and Padua and is edited by Sr. Almerico da Schio, of Vicenza. This is its third year. It is devoted largely to geographical and physical tables and contains a popular calendar. Such annuals have a field of usefulness before them.

—In a note on the *Pilot Chart* for August (p. 189) we spoke of the curious drift of the wrecked schooner "Maggie M. Rivers." She had then zig-zagged off Cape Hatteras nearly six months and had shown no unmistakeable signs of Gulf-Stream drift. Her successive positions have been charted in the succeeding September and October numbers, and we find her now travelling with the Gulf-Stream. From June 26th to Sept. 11 she had drifted upwards of 450 miles a little east of north-east. This is at the rate of about 6 miles per day. The icebergs in the October chart, came but little below the latitude of Newfoundland.

—In the *Kansas City Review* for November is printed a letter from Lieut. Ray, commending in its main features, the proposal of Chaplain Parker to make more use of the Innuit (whom Lieut. Ray calls Inu) in Arctic exploration. In its present form we do not see that Chaplain Parker's proposal materially differs from the usual custom of Arctic expeditions.

—The *Anuario del Observatorio Astronòmico nacional de Tacubaya,* for 1885 is at hand. It is a 12mo., of 341 pages, and is of a somewhat popular character. Of general interest are the tables on pages 132–6 of the longitudes of Mexican cities and the meteorological summaries for the last 4 months of last year for Tacubaya, (pp. 326–335). This is the fifth year of this pleasant annual.

—In "*La variabilidad interdiurna de la temperatura an algunos puntos de la Repùblica Argentina y de America del Sur*" we have an important climatal study by Dr. Oscar Doering, of Cordoba. The parts which have already appeared have been published in the Bulletin of the National Academy of sciences of the Argentine Republic. They are two in number, fill 266 octavo pages and give details of the study for Buenos Ayres and for Bahia Blanca the former on the great estuary of the Rio de la Plata, the latter 350 miles south-west on the smaller estuary from which it takes its name. By the interdiurnal variability is meant the change of the daily mean temperature on two successive days. This may be taken as the datum which expresses the changeableness of the weather for any place and its numerical value is an important indication of the character of the climate. Hann investigated this feature of climate for 90 stations scattered over the earth's surface. It can be viewed from several standpoints but taking for brevity only its annual mean, the smallest found was 11° F for Georgetown, British Guiana, and the largest 7.2° for Moose Factory, Hudson's Bay. The center of the North American Continent, (Manitoba, Hudson's Bay, etc.), has the unfortunate rank of being highest on the list. If we classified a mean of 2° or less as a mild, 2° to 4° as a fair, 4° to 6° as a severe, and 6° to 8° as a very severe climate, then the center of North America and Western Siberia would have a very severe climate, the Northern and Central American states a severe one, the rest of the temperate regions generally fair and the tropics usually mild. On this scale Buenos Ayres (3.°2) would be mild, while that of Bahia Blanca (5.°3) is severe as might be expected, notwithstanding its littoral situation, from the reputation of Patagonia near which it lies.

Dr. Doering was so fortunate as to have a series of 20 years observations for one station and 21 years for the other, each from a single observer. While he praises in unstinted terms the loyalty of the observers who stuck to their work until death called them away, he leaves it to others to call attention to the great and tedious labor which he has gone through in extracting and reducing the data he has employed. They must have numbered about 15,000.

—Dr. Doering in a lecture concerning the *investigation of the climate of the province of Cordoba*, Argentine Republic, given a year ago before the Cordoba section of the Angentine geographical institute, points out how much can be done by amateur meteorologists. He directs their attention more especially to rains, tempests, whirlwinds, frosts, floods and snow.

—The Monthly abstract of registers of the *Meteorological Observatory at Central Park, New York*, is a 4 page large 8vo got up in very neat form without a superfluous word or figure in it. Dr. Daniel Draper is the director, and the readings are obtained from instruments of his own device. As their descriptions are now not easy to get, we propose to reprint them in future numbers of this Journal.

—The *Annales de l'Observatoire impèrial de Rio de Janeiro Tome II*, is a 4to volume of about 400 pages the pagination being separate for the separate parts It contains observation and memoirs for 1882 and 12 charts of the daily gait of the meteorological elements, one for each month. The Meteorological observations at Rio de Janeiro fill 104 pages and those at Queluz, Itabira de Campo, and Rio Grande do Sul, 29 pages more. Among the scientific notes which have been printed in the *Comptes rendus* of the French Academy and are reprinted here is one on the variation in the annual number of storms at Rio. In this note M. Cruls points out a parallelism between the curves which represent the storms as distributed in time and the sunspots plotted in the same way. In some remarks before the Academy on this subject M. Faye suggested that the coincidence might be fortuitous.

—The *Annual Report of the Canadian Meteorological Service* for 1882, is an octavo pamphlet of 158 pages. It consists for the most part of the tabular summaries from nearly 150 stations, including 2 in Labrador and others in Newfoundland and British Columbia. In addition to the usual summaries there are tables of sunshine by hours for Winnepeg, Woodstock, Toronto, Montreal, Sidney and Fredericton.

—We have received three reprints of papers by Professor E. Douglas Archibald, M. A., etc., from the *Quarterly Journal of the Royal Meteorological Society.* The papers are interesting as bearing a marked Indian stamp. The studies of the meteorologists of India have some marked features due to the character of the surface in their field of operations. The mountains of Central India and the towering Himalayas allow them to extend their observations vertically in the atmosphere, and the static conditions of the air-column and the elevation of the neutral plane of monsoons become for them things capable of more or less direct observation. These and similar subjects have received little attention with our meteorologists, but are entirely within the reach of those living near the Rocky Mountains. Professor Archibald's *Variations of the barometric weight of the lower atmospheric strata in India* is a study of air-columns from 4,000 to 7,000 ft. high. It is in pursuit of the answer to the question, Do the temperature-changes cause the annual variations of the monthly means of air-pressure? and he finds the answer to be affirmative. In the two other papers he studies the height of the neutral plane of pressure. The first of the two is a *Note on the reduction of barometric readings to the gravity of latitude 45° and its effect on the secular gradients and the calculated height of the neutral plane of pressure in the tropics.* The author finds that this correction of barometric readings has an appreciable magnitude when the observing stations cover a great extent of latitude, and also have a marked effect on the calculated height of the neutral plane. The second paper relates to the *Height of the neutral plane of pressure and depth of monsoon-currents in India.* In both papers the author shows a critical familiarity with Ferrel's meteorological researches.

—Signor F. Salino's *Tavole-prontuario da 1 a 5000 metri per la misura della altezze col mezzo del barometro*, etc., (Belluno, 1883, 8vo. 24 pp.), is an attempt to simplify barometric computations of altitude by dispensing with the temperature terms of the usual hypsometric formulas. The author finds that a correction depending on the earth's position in its orbit, and which can therefore be expressed as a function of the radii vectores can be applied to a series of normal values and will give a nearer approximation than the tables constructed on Laplace's formula and published annually in the *Annuaire des longitudes.* The normal values and the necessary data for the corrections are tabulated. The discovery seems to have been an empirical one and amounts to saying that the expansion and contraction of the column of air between two stations of different elevation has a simple relation to the radii vectores. This seems improbable but no one can say it is impossible. The true test is in the application and this in the examples given by the author are satisfactory. We have tried it for Ann Arbor where the mean July pressure is 736.6mm, while that of the sea in the same latitude was taken at 761mm. The radial correction for the position of the earth in mid-July for the air-column involved is +0.8mm, and the resulting elevation of the barometer at the observatory is 925 ft. By means of levels from Lake Erie it was made 935 ft., and the difference is not great. With Mr. Dawson's observations (this Journal page 127) taking his observations without elevation correction as giving a mean of 28.92 inches, (=734.6 mm), and the pressure at the seaboard as 762mm, the elevation obtained is 1039 ft., while Mr. Dawson, from rail-

way level data derived from three sources calls it 1075 ft. The table is constructed for a sea-level reading of 760mm, while those employed above are 761 and 762.

The method is simple, the tables handy, and the character of the data especially available for meteorologists. The results obtained are, in the few cases tried, not so aberrant as those derived from the ordinary hypsometric (barometric) formulas. But we must still confess to a distrust of the fundamental principle of the correction employed. If the author will show us that his principle is reasonable and also how to correct for the wellknown variations in mean pressure, he will have deserved the gratitude of meteorologists and geodesists. Some amelioration in the methods of reduction of barometric altitudes is an acknowledged desideratum.

—The November *Pilot Chart* gives the paths of two hurricanes; one is charted as originating in latitude 16° N., longitude 47° W., but the earliest date, that of September 4th, is in longitude 17° W. The storm described the well known hurricane curve, travelling first westward then curving north, then extending its course northeast. It was lost September 14th in latitude 34°, longitude 45°, having, in the ten days, travelled upwards of 1700 miles, This an average progressive velocity of about 7 miles an hour, but in the first day its velocity was about 14 miles an hour.

The other hurricane raged off the coast of the southern Atlantic states. It moved off the coast on the 13th, then turned southward to about latitude 38° then westward and northward, crossing its previous track and thus striking a loop of no great dimensions. The loop occupied it from the 13th to the 17th during which time it travelled about 700 miles, making about the same hourly velocity as the tropical one.

The Captain of the ship "Enos Soule" reports having seen on Sept, 19th, in the mid-Atlantic [longitude 38° W., latitude 8°50′ N], a clump of trees standing about 12 feet out of water. They are of so great a mass as to form a serious obstruction to navigation. Here is a chance for a Jules Verne or Edgar Poe with no embarassing requirements as to how the trees got there or what became of them.

—*Studi sulla oscillazione diurna della declinazione magnetica, par Prof. D. Ragona.**

This is one of several memoirs recently published by Prof. Ragona devoted to a study of the relations between the diurnal fluctuations of declination magnet and meteorological phenomena.

Prof. R. begins by asserting that in a previous memoir, published in 1882, he has shown that the annual inequality in the daily amplitude of the magnetic declination and the annual inequality in atmospheric pressure follow the same law. This conclusion is derived upon the assumption that the two daily elongations in the magnet's progress occur at 9 A. M., and at 3 P. M. This constitutes in his opinion, the first established relation between magnetic and meteorologic phenomena.

Publication of other proofs by him of the foregoing relationship are referred to and the object of the present memoir is stated to be the presentation of additional proof of the principle announced, making use for this purpose not alone of the hours 9 A. M. and 3 P. M. as hours of elongation, but of the hours 8 A. M. and 2 P. M. as well.

An intelligent comprehension of the views presented is therefore quite impracticable without a knowledge of the facts and arguments referred to in the former memoirs, of which this might not inappropriately form a chapter.

Taken by itself it becomes obscure through the lack of a few explanatory notes which might easily have been sup-

* Estratto dal Vol. II, Serie II della Memorie della R. Accademia di Scienze, lettere ed Arti di Modeva, Lezione di Scienze, page 305 e sequente, 18 pp. 4° separately paged.

plied. At the end of the memoir is a double-page table without any heading, but which a note informs us is the "*magnetic observations at this Royal Observatory from October 1, 1881, to March 31, 1883.*" Where "this Royal Observatory" is we might guess with some chance of being correct, but what these observations are it would be very hard to find out from this memoir.

The author terminates his paper with the conclusion that

1st. The amplitude of the magnetic declination, in the course of the year, has a range, between 9 A. M. and 3 P. M., practically equal to that of the barometer; and

2d. The same amplitude between 8 A. M. and 2 P. M. obeys a different law of annual change, but nevertheless always possesses some definite relation to meteorological phenomena.

M. B.

CORRESPONDENCE.

Barometric Observations and Tornadoes.

To the Editor:—No. 5, p. 175, "This question of barometric observation in the centre of a tornado is a very important one."

Various Signal Service stations have been struck; cannot the observations be had for your readers and the minimum for those stations?

Yours, J. F. Lewellyn.

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